DRAGON USER

International edition

The independent Dragon magazine

60p US$2.60 November 1983

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How to submit articles

The quality of the material we can publish in *Dragon User* each month will, to a very great extend, depend on the quality of the discoveries that you can make with your Dragon. The Dragon 32 computer was launched on to the market with a powerful version of Basic, but with very poor documentation.

Every one of us who uses a Dragon will be able to discover new tricks and quirks almost every day. To help other Dragon users keep up with the speed of the development each of us must assume that we made the discovery first — that means writing it down and passing it on to others.

Articles which are submitted to *Dragon User* for publication should not be more than 3000 words long. All submissions should be typed. Please leave wide margins and a double space between each line. Programs should, whenever possible, be computer printed on plain white paper and be accompanied by a tape of the program.

We cannot guarantee to return every submitted article or program, so please keep a copy. If you want to have your program returned you must include a stamped, addressed envelope.

Contents

SUNSHINE

Editorial

THE DRAGON BOOKED a place in the sun for the first weekend in November — heading for a Californian computer show covered in this issue. US marketing of the machine is now going ahead strongly, and this show is just one part of Dragon-Tano's strategy to spread the word about the Dragon throughout the US. One of the oldest jokes about America is that when it was shaken all the nuts started rolling and came to rest in California — a reflection on the enthusiasm many Californians seem to develop for esoteric subjects. This month the Dragon too started rolling, coming to a halt in Pasadena where it took top billing at the Colour Computer Exposition.

This doesn't mean that claws will be appearing alongside the footprints of the stars commemorated forever in cement on Hollywood Boulevard. What it does mean is that the Dragons 32 and 64 had pride of place at the first West Coast Colour Computer fair. But the background to the show is more interesting than the presence of the machines themselves. It began life as a project organised by local users, but the scale of response led to other organisations taking a hand. This is hardly surprising when you consider that a Colour Computer weekend was declared in Los Angeles and Pasadena to coincide with the show.

This level of official interest far exceeds that displayed in the UK for events such as this autumn's *PCW* show. The 50,000 visitors to this show were not dazzled by the glint from local dignataries' medals of office — nor did they see their interest taken up so warmly by London's administrators. Californians may indeed have some strange interests. But while there is no official policy in this country on aerobics, microcomputing ranks high on our list of priorities. It would be good to see this high ranking translated into some show-level action.

The *PCW* show, however, did have a lot to offer Dragon users. The 64, in its demure grey casing, was the only new micro on display, and two add-ons for the Dragon made their first appearance — a Viewdata interface and a Colne Robotics arm. Addicts of arcade games also found a lot to reward their passion. But quieter moments were equally rewarding — for example, when one member of Dragon Data's staff turned off the arcade game on display in order to talk with a deaf and dumb user via the monitor.

Making room

DOES YOUR Dragon run out of memory when using large graphic arrays?

Recently I got my hands on an IBM PC with all mod cons. While reading the Basic manual I came across this piece of interesting information. I tried it on the Dragon and it works.

When GETting a screen image it is not necessary to use a two-dimensional array. The Dragon will quite happily store your pictures in a one-dimensional array. For example:

To save an area 60 × 60 using the Dragon manual you would DIMA(60,60) : GET (0,0) – (60,60),A,G

The same can be done using DIMA(100) : GET (0,0) – (60,60)A,G

While I don't know the internals, the effect on the memory is clear. Because "A" is an integer (numeric) array it uses two bytes for each element (60 × 60 × 2 = 7,200 bytes). The difference between the two methods is 7,000 bytes.

Having done a few tests, I found a fairly constant ratio of 36:1 between the product of (X2 – X1) × (Y2 – Y1) and the array needed to hold it. For example:
(0,0) – (60,60) = 3600/36 = 100
(60,60) – (120,120) = 3600/36 = 100
(0,0) – (12,12) = 144/36 = 4

It is, of course, wise to round upwards, but the saving space will give you room to add extra frames to improve animation, or to overlap frames and reduce the flickering produced by blanking out between frames.

M Hedley,
Devon.

Corrections 'wrong'

I WISH to thank M J Kerry for his letter published in the September issue in which he clarified a couple of points mentioned in my article "Getting to grips with input/output".

It is ironic though that his letter should be titled "Getting it right" when the very first point he made is clearly incorrect — the triggering of the cassette relay *is* handled by an interrupt, as I stated in my article. It would seem that Mr Kerry has made the mistake that many novices make in assuming that all interrupts are handled by the MPU; in actual fact interrupts called by the PIA are always serviced by a PIA interrupt which interrupts the MPU.

There are two PIA interrupts — IRQA and IRQB — which service the four interrupt lines, CA1, CA2, CB1, CB2. They must not be confused with the MPU interrupt IRQ which is entirely different. But this is not to say that MPU interrupts cannot be called in addition — they can, quite simply by checking the contents of the PIA. For example:

```
LDA (FF21)
CMPA $14
BNE + 1
SWI
RTS
```

This short subroutine would call on SWI interrupt, once the PIA IRQA had switched on the cassette relay.

SWI, SWI2, SWI3, are not used by the Dragon and are free for use by the programmer). An MPU interrrupt is also called if the PIA interrupt line is linked directly to the MPU interrupt line; this is how the cartridge FIRQ works.

Ian Nicholson,
Merseyside.

Clarifying TRACE

THE TRACE facility on the Dragon, used as the handbook suggests, can cause more confusion than it seeks to clear.

Any program screen display gets buried in a mass of scrolling line numbers, especially if any INKEY$ is involved. This can cause difficulty when deciding where to stop or "break" the run when checking for errors. In my case, these errors always seem to occur between half and two-thirds of the way through the program.

In desperation, one day I tried:

```
499 TRON
----------
558 TROFF
559 STOP
```

It worked! There it was — the display (text in this case) and the line numbers of the area of program giving trouble — static for study.

It works in graphic modes too, but you will have to add the relevant SCREEN command if you wish to CONT.

R Hames,
Milton Keynes.

DREAM difficulties

HAVING RECENTLY purchased Dragon's DREAM Editor/Assembler, I had great difficulty in getting the program to record text on tape. Although the program went through the motions, what was recorded on tape could not be read back at all.

Having disassembled the program, I am now able to offer a quick solution.

The problem is that DREAM sets the number of hex 55 leaders to four, which is not nearly enough. The number of leader bytes used is stored at address hex 746B, so all that is needed is to poke a larger value to this location then resave DREAM. The following sequence will accomplish this:

CLEAR 200, 10000
CLOADM "DREAM" (and load the DREAM cassette).
POKE &H746B, 128
CSAVEM "DREAM", &H6C80, &H7FFF, &H6C80 (to save the modified DREAM program).

A Jolly
London SE12.

Memory locations

I WOULD like to point out some useful memory locations. In the manual there is a memory map but that is all.

$B2 — foreground colour
$B3 — background colour
$B4 — active colour
$B6 — graphics mode
$B9 — count of bytes in a row of graphics
$19 — beginning of text
$23 — top of string free place
$71 — RESTART FLAG. If ($71) ≠ $55 then a full cold start will be performed on RESET.

Adrian Nicholls,
Read,
Lancashire.

Clearing a screen

HERE IS a new way to clear a screen row by row.

10 FOR I = 1024 TO 1535 : POKE I, 128 : NEXT I

Running this will clear the screen black. To change the colour this is all that needs to be done: Change POKE I, 128 to

(Green) POKE I, 143
(Yellow) POKE I, 159
(Blue) POKE I, 175
(Red) POKE I, 191
(Buff) POKE I, 207
(Cyan) POKE I, 223
(Orange) POKE I, 239.

Roger Alexander,
Burntwood,
Staffs.

Leap year solution

MICHAEL HOLLAND'S program Calendar, in August's *Dragon User,* appears to contain an error — the dates for the month of January are incorrect in leap years. Addition of the following line should correct this fault:

335 IF Y/4 = INT (Y/4) AND M = 1 THEN T = T – 1.

As a relative newcomer to computing, and a great believer in the value for money of the (British) Dragon, your magazine has come as a welcome and useful publication.

C Woodhouse,
Atherstone,
Warwickshire.

Software Top 10

1	(2)	**The King**	Microdeal
2	(3)	**Frogger**	Microdeal
3	(4)	**Android Attack**	Microdeal
4	(6)	**Nightflight**	Salamander
5	(5)	**Space War**	Microdeal
6	(9)	**Ring of Darkness**	Wintersoft
7	(—)	**Dragon Tracks**	Wintersoft
8	(8)	**Planet Invasion**	Microdeal
9	(—)	**Morocco Grand Prix**	Microdeal
10	(—)	**Quest**	Dragon Data

Chart compiled by Boots


The ADVENTURES of MONTY The Mountaineer
De Apibus Semper Dubitandum Est.
"AVALANCHE!"
MONTAGUE MONTAGUE III, DUKE OF BOLTON, HAS ORGANIZED AN EXPEDITION TO CLIMB MOUNT EVEREST, BUT MONTY AND THE TWO OTHER BRITISH CLIMBERS, IAN AND TOM, DID NOT RETURN TO CAMP THE PREVIOUS NIGHT. THE AMERICAN, HANK, TAKES CHARGE OF THE SEARCH PARTY...
"LEE, YOU GO WITH FRED BACK TO BASE CAMP AND GET MORE SUPPLIES. CARL AND I WILL SEARCH FOR THE OTHERS."
"SURE THING, HANK! WE'LL SEE Y'ALL BACK HERE LATER."
"GUT. DIS MAY VELL BE MY CHANCE TO DISPOSE OF ZIE SCHWEINHUND AMERIKANER!"
NOT FAR AWAY, MONTY, TOM AND IAN ARE TRAPPED AT THE BOTTOM OF A CREVASS.
"DASHED LUCKY REALLY, THAT THIS FISSURE HAS SHELTERED US FROM THE WEATHER. YOU SHARE THE LAST GINGER NUT, CHAPS. I AM SURE THAT AID IS IMMINENT."
"HAVE THE GINGER, TOM, I'LL TAKE THE NUT"
MEANWHILE, AT THE TOP...
"LOOKY HERE WHAT I'VE FOUND, CARL. MONTY'S HAT. THEY MUST BE TRAPPED BELOW."
"AND IN A MINUTE, SCHWEIN, YOU WILL JOIN ZEM IN OBLIVION."
SUDDENLY, THE TWO CLIMBERS HEAR A NOISE ABOVE THEM...
RUMBLE
"GOTT IM HIMMEL!"
"WATCH OUT. AVALANCHE!"
WILL HANK AND CARL SURVIVE THE AVALANCHE? WILL MONTY BE RESCUED? WILL CARL'S EVIL PLANS COME TO FRUITION? WILL THE AARDVARKS REACH THE SUMMIT OF MOUNT PALOMAR BEFORE PETERKINS THE FERRET-STRANGLER?
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PRINT document
RENAME document
TAPEPRINT prints all documents on a tape

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Other Dragon Software:
Chess (cartridge) **£24.95**; Hi-res character set, **£6.95**; Lothlorien: Samurai Warrior/Tyrant of Athens, **£6.90** each; Compuden: Dragon Magic 1/Dragon Magic 2, **£6.95** each; Quark Data: Space Crystal, **£6.95;** Cable Software: Drone, Dragrunner, Baccarat, Cave Fighter, **£8.75** each.

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Dragon 64 to enter shops this month

THE WAIT for the Dragon 64 is over — the new machine will be in the shops in November, along with the OS-9 operating system.

The 64 has three different modes. It can operate as a 32 (ensuring full software compatibility), as a 48 (with 16K going to the Basic interpreter), and as a fully soft 64.

In addition to Basic, Pascal and Cobol can be used on the 64. Thoth Data Systems will also be offering the modular language Mumps on the 64 — at about £100 including utilities software and a screen editor.

The new micro, which comes in a grey case the same size and shape as the 32's, also features an RS232C interface. This makes it compatible with a wider range of printers and other peripherals such as modems.

Dragon Data is aware of the need to provide an upgrade service for 32 users. The plan is to offer various packages enabling this at the beginning of next year, if not earlier.

The 64 costs £225 and will be available through the usual Dragon dealers, including Boots and Dixons. But the cost of the disk-based OS-9 System had not been decided as we went to press.

OS-9 gives users a range of business applications, and packages such as Dynacalc will be available — stock control, accounting and spreadsheet analysis will all be possible.

As Richard Wadman, Dragon Data's marketing director, commented, the combination of the 64, OS-9 and drives gives the company "the means to enter other markets". He is sure Dragon Data's move upwards will be as successful as its entry into home computers.



The Dragon 64: software compatible with the 32

Viewdata interface available

A VIEWDATA interface for the Dragon was also displayed for the first time at the *PCW* show.

It gives a 40 x 24 display with upper and lower case alphanumerics and block graphics in green and black or white and black on the Dragon high-resolution screen.

The networking software allows you to talk to Micronet, Prestel and other viewdata systems. The software includes facilities to print pages, write mailbox messages and load and save pages to tape.

With the interface, software can be downloaded, including routines for other micros written in Microsoft Basic.

The interface plugs into the Dragon cartridge port and auto-runs.

Microcomputer Resources is manufacturing the interface and Prism will be its distributors.

It is expected to sell for about £50, or for £120 as a package including modem — although special offers may be available from Micronet when it offers the service.

Games on the way for Christmas

PRODUCERS OF software for the Dragon took the chance offered to them by the recent *PCW* show to show off their latest wares and give us a taste of what to expect for Christmas and in the New Year.

Market leaders Microdeal put on one of the most impressive software displays at the show.

Games on show included: Cuthbert in the Jungle and Cuthbert goes Digging (follow-ups to the successful Cuthbert Goes Walkabout), Crazy Painter, Intergalactic Force (a game based on Star Wars), Keys of the Wizard (a text adventure) Danger Ranger, Scramble, Eight-ball pool, Pinball, Devil Assault, Dragon Hawk and Rainbow Writer, an editing program.

Some of these have just been released; the others according to Microdeal's Alan Hobbs, will be available in November.

Like Microdeal, Dragon Data too is expanding its software catalogue in time for Christmas.

New arcade games we can expect to see by then include: Cosmic Clones, Moon Hopper, El Bandito, Jump Jet and Starfighter.

Salamander Software also has a number of programs coming out in time for Christmas.

There's good news for Dragon users enmeshed in the mystery of Franklin's Tomb. The third part of this trilogy — following on from Franklin's Tomb and Lost in Space — is Fishy Business, which should be out in time to be included in Santa's list of goodies.

November will see the appearance of Lazer Zone (a Dragon version of the Vic20 game) and Filing System.

Wessex expands your Dragon

IF YOU'VE been wondering how to use cartridge software and disk drives at the same time, Wessex Microcomputers has the answer.

Its Wyvern expansion box also provides facilities for memory expansion and instrument control, along with an IEEE connector.

With the box, the page mode/memory management logic can be poked to access an external block of up to 64K of memory or mixed input/output functions.

Wyvern, designed in co-operation with Compusense, plugs into the cartridge socket and costs £69.50. Other add-ons expand the range of things you can do with the box.

Games and Computers is also offering an I/O board allowing your Dragon to control external devices.

Its MXT I/O controller slots into the Dragon's cartridge port with a base to provide firm support, and can control up to four devices.

Two models are available, one at £49.95 with four switches and one at £39.95 with two switches and two TTL lines which electronics experts can put to their own use. Both models come with a manual explaining their use.

The controllers can be used in the home or office, for example operating central heating or a burglar alarm system.

Flex option for Dragon

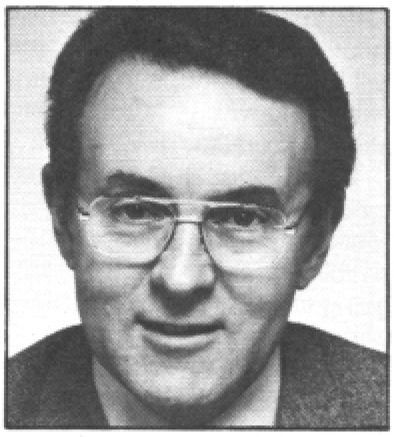
DRAGON USERS are going to have a choice of operating systems — while Dragon Data itself has opted for OS-9, Microcare will be offering Flex.

Flex is a longer established system, with more applications software available, but OS-9 offers the possibility of multi-tasking.

However, Eric Brooks at Microcare argues that the lack of multi-tasking is not a problem. For £60 his company is already offering Flex on the Premier controller which is used for Cumana drives reviewed in this issue.

These drives are available in single-sided 40 and 80-track formats, and double sided 80-track. Cumana is already working on dual slimline drives placed side by side.

Cumana is not afraid of the challenge from Dragon Data. Chairman Don Bolton commented that Cumana will manufacture 3,500 drives before Christmas — "and we intend to sell them".



Cumana chairman Don Bolton.

Microcare intends to be offering Flex on Dragon Data's own drives by the beginning of November, again at about £60.

A range of applications software will also be available then for both systems, including Pascal and utilities such as Dynacalc and Dynastar.

Microcare is already offering an upgrade service to 64K for 32 users.

The company also intends to enhance the Dragon's screen display. Screen upgrades range from an 80-column card to an option giving a full display of 85 by 28 characters.

Dungeon enters software business

THE DRAGON Dungeon has gone into the business of selling software for the Dragon.

The Dungeon's adventure specialist, Mike Meineck, has been busy writing five of their first six releases, and one game, Crystal Chalice, is tipped to be a top-seller.

It is a classic text adventure but relies on computer intelligence rather than the elements to provide play challenge.

The swords and sorcery scenario creates memorable characters which will reappear in the sequel Return of the Klarz, later this year.

The Temple of Zoren, a science fiction adventure involving espionage on an alien planet, has Star Wars qualities which could make it popular.

Eight to 16-year-olds will have to battle against fire, flood and 48 lethal guardians in search of Merlin's treasure in the Treasure Tombe.

Giant's Castle is designed to give children in the seven to 11 age group a taste of adventure. The fights with giant creatures are won or lost by answers to general knowledge questions.

Midas Maze is aimed at the same age group. In it, the player relies on a good fairy to steer him or her clear of magic holes and other hindrances in the maze.

Mark Jones, 13, of Nottingham, designed Maths Trek, the only game not written by Mike Meineck in this first group of Dungeon releases. It is designed to test mathematics using a Star Trek type game.

The Dungeon's adventure range will cost £7.95. Junior and educational ranges are priced at £5.95.

The new man at Dragon's helm

THE NEW man in charge of Dragon Data is Brian Moore, moving down to Wales from electronics giant GEC.

Brian has a wide range of experience, including engineering, financial management and business applications for computers.

Before moving to Dragon Data he was deputy managing director of a GEC subsidiary specialising in microprocessor-controlled heating and ventilation systems.

He is "very interested in Dragon Data's move into the business market" but is equally keen to "look after the large number of Dragon 32 users".

He promises that the Dragon 128 (a working title only, the machine will have a different brand name) will offer different brand name) will offer "something exciting," including new marketing moves.

Dragon Data's former managing director Tony Clarke left late this summer. The company's shareholders asked GEC to provide a senior executive to replace Tony and Brian moved in on the 12th of September. The request was for somebody on "temporary secondment" and Brian expects to be with Dragon Data until a new business plan has been worked out for the company — at the moment he cannot put a time on this.

His appointment followed the announcement that Dragon Data had sold fewer machines during the summer than expected and that an extra £2.5 million was being put into the company.

Brian has no doubts about the company's financial status, commenting that in its first year of business Dragon Data is expected to have gone from nowhere to an £18 to £20 million turnover.

Virgin software hits the road

VIRGIN GAMES plans to take computers to the people this month with a tour of major British towns.

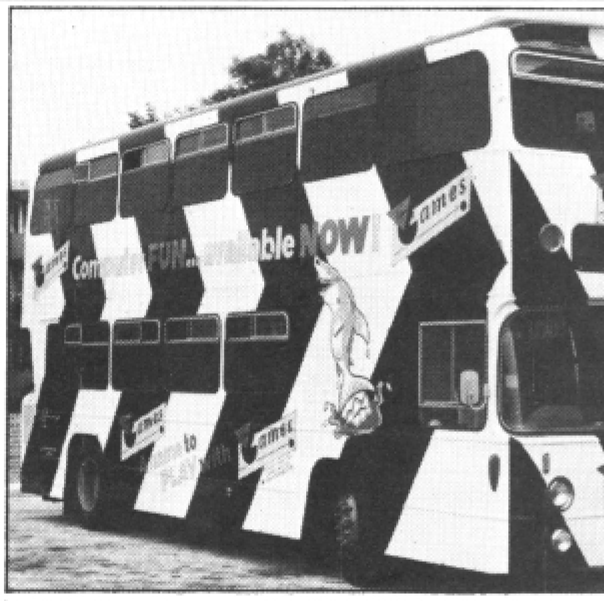
The company has refitted a double-decker bus with 12 computers including the Dragon 32.

Details of the tour are yet to be announced but the company plans to launch eight new programs when the bus heads off.

The three new Dragon programs will be Death Cruise, Castle Adventure and I Ching.

The designer of Death Cruise, Lee J. Brookes, 27, of Chesterfield, has since taught himself assembly language and hopes to compose future programs in machine code.

A 14-year-old school boy, Conrad Jacobson, from Manchester, designed Castle Adventure.



The Virgin bus . . . taking software to the people.

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* * * * *

THE STRIPPER – a machine language utility designed to cut the size of BASIC programs for run time efficiency. All remarks in a program are removed and any branch references to the lines are changed. Individual commands are packed into multiple statement lines where possible for dramatic savings of memory, and all unnecessary spaces are deleted from the code. THE STRIPPER can squeeze more performance, data and program from your machine for only $19.95 US

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Dragon spreads its wings wide

A look at just how far overseas the network of Dragon users has spread.

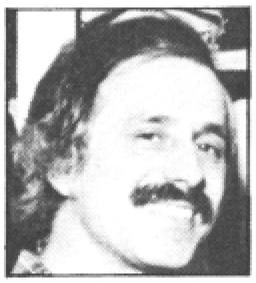
SALES OF THE Dragon computer are booming all around the world — and with the increase in sales has come a big jump in the number of users wanting to keep up with the latest news about their machine.

Meeting other users and swapping information about the Dragon is easy for people living in the British Isles — after all, the manufacturer is based in Wales, there are numerous computer clubs to join, and there's even an independent magazine based in London and devoted to the Dragon (that's us, in case you didn't guess).

But for Dragon owners overseas it's been a different story. Often they find themselves with their Dragon, a manual and little else. However, some attempts have been made to reach these "outposts" of Dragon owners. *Dragon User* has gone international and Dragon Data, the manufacturer of the computer, runs a service to put users in contact with each other.

But now, it seems, Dragon owners overseas are taking things into their own hands: large numbers are getting in touch with established clubs in Britain. Two of the country's largest clubs, the Dragon Owners' Club (run by Dragon Dungeon) in Derbyshire and the Dragon 32 Users' Club (run by Games and Computers) in Dorset, can boast a truly international membership.

Says John Richardson, of the Dragon 32 Users' Club: "It has amazed us how many people have contacted us from overseas. We have about 1,400 members altogether; of these, about 160 are overseas." John says that "virtually every European country" is represented in the club, with the largest number coming from the Scandinavian countries, "Iceland in particular".





John Richardson (left) and Peter Woods . . . both their clubs for Dragon users have extensive overseas membership.

Peter Woods of the Dragon Owners' Club has also had a lot of Scandinavians joining up. He estimates that about 75% of the club's overseas members come from Scandinavia.

Strangest places

The Dragon Owners' Club also has some members in what may seem the strangest of places. There are, for example, about a dozen in Saudi Arabia. No, they're not wealthy oil sheiks filling in their spare time with a Dragon — they're Britons working there who couldn't bear to leave their Dragons at home. There's even an owner flying the Dragon flag on the Falklands.

Other overseas members come from such exotic places as Malaysia and Hong Kong. Peter Woods explains: "They come over here as students, get a Dragon while they're here and then go back and spread the word."

Interest in British clubs has also spread in the other direction — across the Atlantic. Both clubs now have an American connection — the Los Angeles Colour Computer Users' Group. The idea behind this link is essentially for owners of the Dragon and the work-alike Tandy Colour Computer to swap information, but the Dragon's release in the States will surely stir up more interest in Dragon clubs.

There is every likelihood, too, of even more European interest. Once again, the Scandinavians look set to lead the way.

A spokesman for Informasjonssystemer, one of Norway's major computer retailers, told *Dragon User* of an upsurge in Dragon sales in Scandinavia. He said that since March, 2,500 Dragons had been sold in Norway alone and added that in the month after his company moved into the Swedish market sales there had reached 1,500. The company expects sales of between 10,000 and 15,000 this year in those two countries and Finland.

Dragon User knows of no clubs in Scandinavia on the scale of those in Britain, but it can only be a matter of time before we hear of a "Scandinavian Dragon Users' Club" being formed.

The situation in central Europe is pretty much the same. In France, for example, the Dragon is rapidly gaining in popularity — Dragon Data (France) reports sales of 5,000 so far and expects to sell at least 20,000 this year — but there are no known clubs.■

Dragon clubnet

Derbyshire: Dragon Owners' Club, Dragon Dungeon, PO Box 4, Ashbourne, Derbyshire — publishes *Dragon's Teeth.*

Devon: Ian Chipperfield, Brixham Dragon Owners' Club, 22 Brookdale Court, Brixham, Devon — meets every Saturday afternoon.

Dorset: Dragon 32 Users' Club, Games and Computers, 31 North Street, Wareham, Dorset — publishes newsletter.

Essex: Doug Bourne, Dragon Independent Owners' Association, School House, Nevern Road, Rayleigh, Essex — publishes *The Dragon's Tale.*

Lancashire: Melvin Franklin, North-West TRS-80 Users' Group, 40 Cowlees, Westhoughton, Bolton, Lancs — growing number of Dragon users, meets monthly at Irlam near Manchester and publishes newsletter.

London: 68 Micro Group, 41 Pebworth Road, Harrow, Middlesex — publishes *68 Microcosm* and meets on the fourth Tuesday throughout the year in the Regent's Park Library, Robert Street, London NW1, all 68XX owners welcome.

Staffordshire: Tony Beckedd, Tame Computer Club, 57 Adonis Close, Tamworth, Staffs — an all-user club including 15 Dragon owners, meets fortnightly.

Wales: Dragon Users' Club — publishes Stop Press. Dragon Data, Kenfig Industrial Estate, Margam, Port Talbot, West Glamorgan.

Wiltshire: R Gould, 39 Cullerne Road, Stratton St Margaret, Swindon, Wilts — interested in forming Club 32.

Scotland: David Anderson, Scottish Dragon Club, 1 Walker Street, Edinburgh — regular newsletter.

South Africa: Ian McCall invites other SA Dragon owners to contact him at 35 Silwood Road, Rondebosch, Cape Town.

Dragon Users Club

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Winter brings a whole new world of games

*Software reviewer **John Scriven** abandons the outdoors to start exploring micro-worlds*

AS WINTER APPROACHES and icy winds start to howl across the country, many people are discouraged from venturing too far from the comfort of their homes. Micro owners come in from the cold to seek excitement at the keyboard. What better thing could there be than to remain in the warm and dry while your Dragon leads you to explore the rest of the universe from a warm armchair?

I sometimes wonder if it's always a good idea to seek escape in different micro-worlds. In the not too distant future video disks will be combined with computers to provide a realistic environment in which we are not mere passive observers, as with TV and films, but active participants who can control our own destiny. Perhaps the Brave New World of "feelies" as well as movies is closer than we imagine. I can imagine a scene where all our experience is obtained from some processor-controlled video. No longer any need to visit castles — the machine takes us there; no need to fly — the simulator does it for us. The ultimate conclusion is that we won't need bodies — the internal, cerebral experience will be enough.

If you think I am overstating the danger, then think back to the last time you became so involved with a program that time, meals and other people disappeared totally from your mind. Most of my friends who use computers are pleased to escape from them into the country or on to the beach, but there are one or two who show the danger signs; glazed eyes, computer language creeping into normal conversation, excuses as to why they can't come out in the evenings. Still, I expect they said the same about Caxton when books first appeared!

Varied quality

This month's selection includes several programs to produce glazed eyes, though not all for the same reason. As usual, the quality varies enormously. If only the software improved at the same rate as the packaging.

First on my screen was Space Shuttle from Microdeal. Consisting of a more elaborate version of a flight simulator, the object is to pilot the shuttle through a complete mission. The display initially shows a weather report — side winds on landing can create problems — and then countdown begins. The screen now shows a central band of window, with a bewildering array of instruments below and status reports at the top. The view outside is of clouds that soon give way to stars as you gain in altitude.

At this stage you leave the launch rocket and have some control over the shuttle. Use of the joystick enables left/right and up/down movement as you steer towards the correct orbiting position. Things increase in complexity at this point as you attempt to rendezvous with a satellite. As well as the joystick, you have to alter the retro strength to change your velocity. Once you are close to your target, the doors have to be opened, the robot arm extended, and the satellite placed neatly in the cargo bay. Surprisingly, this is the easiest task of all.

As the doors close, you can fire forward thrusters to begin your descent through the atmosphere. The motors shut off and you control the final glide using only the joystick. Instruments are necessary in the initial stages, but soon the runway appears through the window and the landing can be achieved visually.

After you land successfully — or crash — a debriefing report tells you where you went wrong during the mission. As you are a trainee pilot, each stage has predefined limits for success — for example, you are not allowed to attempt to put the shuttle into orbit at a height of 10 feet above the ground. If you are outside the limits or you take too long, the stage is aborted automatically and the next begins. Points are awarded according to your skill at each manoeuvre.

Under review

Microdeal 41 Truro Rd St Austell Cornwall	**Space Shuttle**	£8.00
	Frogger	£8.00
	Cuthbert Goes Walkabout	£8.00
	Golf	£8.00
	Morocco Grand Prix	£8.00
	The Composer	£15.00
Dream Software 29 Ardmore Rd Derruad Craigavon Northern Ireland	**Dragon 1**	£4.95
Programmers' Guild Ahead House Sandbeds Ind Estate Ossett W Yorkshire	**Pacdroids**	£8.95
	Protector	£8.95
Premier Microsystems 208 Croydon Rd Anerley London SE20 7YX	**Cribbage**	£8.95
	Spider	£4.95
	Spelling	£6.95
	Adventure Plus	£7.95
	Plant Ecology	£5.95
	Maths Games	£9.95
Salamander Software 17 Norfolk Rd Brighton East Sussex BN1 3AA	**Gridrunner**	£7.95

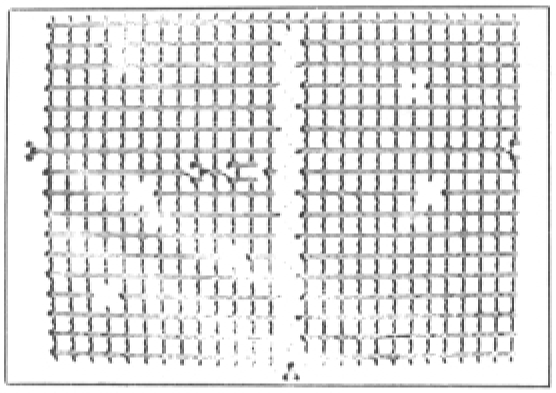
Well thought out

A well thought-out game, Space Shuttle encourages you to reattempt the difficult sections and improve on your score. The game is reasonable value at £8, the instrumentation clear, and tne outside view about as good as can be achieved on a Dragon.

The packaging includes a 16-page training manual that explains each stage clearly and gives assistance in control movements. The packaging is rather strange — a block of expanded polystyrene the size of a video-cassette holds the cassette and the booklet. Once you take off the clear wrapper and the paper cover, there is no cassette case, and you either store the cassette on its own allowing dust to enter, or wrap it up in the large chunk of white plastic, which looks untidy.

A firm that has gone for mini video-cassette cases for their packaging is Premier Microsystems of Croydon. It produces a range of games and educational software that caters for all tastes.

Maths Games contains four programs to improve mental skills. They all follow the same format, simply numbers appearing on the screen that have to be operated on in the head and the correct answer entered. The addition program, for example, shows number sets like 2 + 5 + 7 + 3 ►



Gridrunner: popular in the US

◀ + 12 + 8 for a few seconds . . . These disappear and the correct answer has to be input. If correct, a fresh set of numbers appears, plus an extra number, so this is a test of memory as well as mental agility. Although I have reservations over the educational value of such programs, it certainly provides plenty of practice. I feel that it wouldn't appeal to those children who would benefit from it most, however, as there are no complementary graphics. The multiplication program is a lot better, as it shows a number of dots in two boxes that have to be counted before being multiplied together. I also liked the division program, which gave alternative answers to a problem, and also allowed a lot longer to work out the answer.

Although Dragons aren't common creatures in classrooms, these programs could offer extra help to parents. It's a shame that the displays could not have been livelier — children are more likely to retain knowledge if it's acquired in an enjoyable way, and these programs, although efficient, tend to be a little boring.

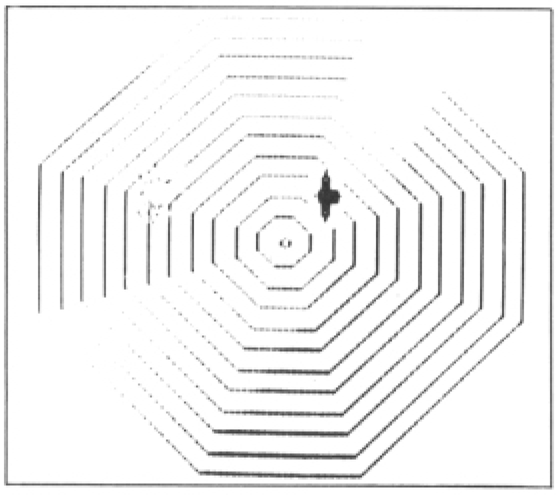
Spelling confusion

Spelling from Premier attempted to confuse me by including a maths program first. Basically a simple four rules test, it displays the figures in a large form and put ticks or crosses next to the answer. There is no attempt at graphics, and it was not much fun to use. This was followed by the main program, Spelling Test. Spelling programs always present difficulty in presentation. Either the word has to flash on the screen, or there has to be an accompanying sound track of the word, or alternative spellings have to be shown. Premier have chosen the last route, giving a choice of four spellings for each word. Difficulty levels vary from 1 to 6, easy words being holiday, people, etc, and hard words begin at the level of ecstasy, rejuvenate, etc. The words are held in data statements, so a parent or teacher could substitute any words, including foreign or scientific words as necessary. While not being tremendously impressed with the program, I found it perfectly competent and worth considering if practice in spelling is considered necessary.

All about plants

Plant Ecology from Premier tackles a learning situation in a much better way. While teaching about energy levels, sunlight, soil fertility, etc, the format is that of a "Kingdom" type game. The environmental conditions are shown in a table, listing sunlight, temperature, rainfall, competition and wind. Beneath is shown your condition, from roots and leaves, through flowers and seeds to the number of new plants produced. You can supply energy to different parts of your plant through the seasons, and the object is to survive and produce as many new plants as possible. Natural disasters occur, such as weed killer spills, as well as more pleasant happenings like surprise gifts of fertiliser. Each strategy employed also has a display of your plant, complete with the roots, leaves, etc, that you possess at that stage. This program would liven up a botany lesson, and promote discussion if used with a group of children. I'm not sure how much pure plant knowledge would be acquired using this program, but reasoning skills would be sharpened as different approaches are tried.

Adventure Plus is the only adventure game from Premier. It is a text-only version that allows you to explore a house picking up various objects. The room descriptions are rather brief, and though some of the problems take some time to solve, it does not compare with Dragon Data's range of machine code adventures. The vocabulary it recognises is rather limited, and there are irritating requirements such as having



Spider: better than it looks

to type "go north" in full each time. Although I wasn't very impressed by this game, it was no worse than the Microdeal series and could well appeal to adventurers in search of fresh ground.

Enter the spider

When I first loaded Spider, the only arcade-type game from Premier, it didn't look too promising. The display is very simple — an eight-sided web, two spiders and a fly. The object is to move your spider (the large male one) over the flies to satisfy your voracious appetite. Unfortunately, the female spider has an even greater hunger for you! Female spiders being what they are, they don't have much use for you afterwards, and you disappear from the screen. You also disappear if you don't eat enough flies. As I played the game, it was clear that it was better than I had feared, but it is still not really up to the impressive packaging.

My favourite program from Premier was Cribbage. I have not seen any versions of this traditional card game for any other machine, and it was surprisingly good. Briefly, the game is as follows:

Each player is dealt six cards, of which two must be thrown away. The next card in the pack is turned up to show its face. The four discarded cards make up the "crib" which is placed to one side. Using the retained cards, the players take it in turns to place cards in a pile, adding up the value of the pile all the while. Runs and doubles score points, as does making 15 or 31. The total must not come to more than 31. If it does, then the totalling starts again. When all eight cards have been played, the players try to make 15 from their own cards (including the upturned card on the pack). They take it in turns to add the crib score to their own. Scores are usually kept on a wooden board with holes in for matchsticks. The winner is the first person to move his or her matchstick around the board.

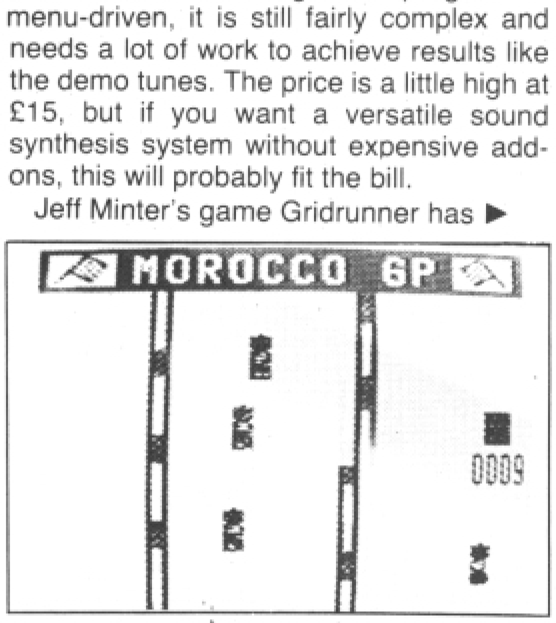
The display is very clear, with the cards shown along the top of the screen, and the reaction times are fast. Although not as much fun as playing in the back room of some country pub, this is an enjoyable game and what's more, it was played fairly. (Cribbage seems to bring out the worst in humans!) Perhaps this signals a return to traditional pub games on computers. I shall keep my eyes peeled for the first Shove-Ha'penny game on cassette.

Making music

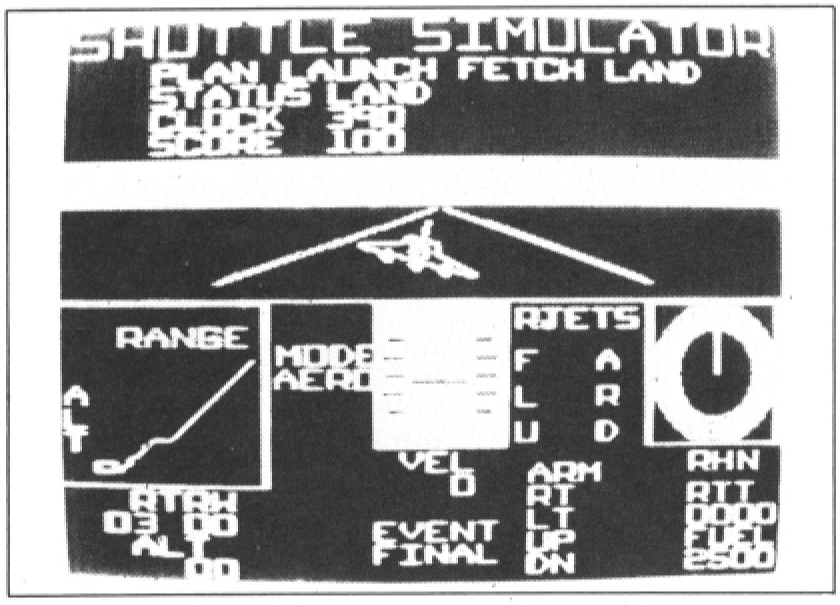
Although the Dragon has a reasonable number of commands to access the sound chip, Dragon Basic does not allow a large number of different effects. It is necessary to use machine code to exploit the full potential of the machine. An alternative solution is to use a program such as Composer from Microdeal, which effectively extends Basic by allowing you to enter complex melodies into DATA statements. In this way harmonies can be written, and quite complicated melodies incorporated. There is a selection of tunes already prepared as a demonstration, and the result is impressive.

The melodies that you enter are compiled into machine code by the program, and the machine code file saved separately. This is how music can be used in your own programs without the need for complex routines or extra memory. There is an accompanying 28-page booklet that goes into considerable detail. This is just as well, because although the program is menu-driven, it is still fairly complex and needs a lot of work to achieve results like the demo tunes. The price is a little high at £15, but if you want a versatile sound synthesis system without expensive add-ons, this will probably fit the bill.

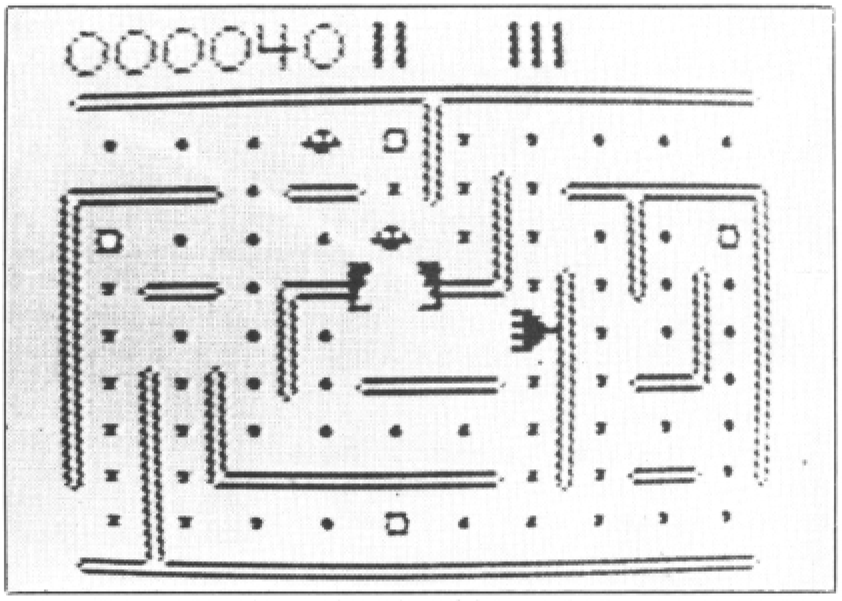
Jeff Minter's game Gridrunner has ▶



Morocco Grand Prix: not "addictive"



Space Shuttle: a well thought-out game from Microdeal



Pacdroids: a more advanced version of the popular Pacman.

◀ been released under the banner of Salamander Software. A fast-moving machine code game needing one joystick, this consists of a grid of approximately 27 x 17 lines, down which move search squads (this part is similar to Caterpillar). You control a base over the bottom half of the screen and attempt to destroy the squads before they reach the bottom of the screen. If you remain in one place for too long, X/Y zappers will line up on you and fire plasma beams. Other obstructions are caused by pods appearing in your path. Although I found it a little tiresome, some of my friends think it's great fun and it's very popular among arcade freaks. Apparently this is one of the best selling games in the States, if that's any recommendation.

More arcade games

Yet more arcade games seem to be streaming out of Microdeal. The latest releases include "The Official Frogger" under licence from Sega. The graphics were a little disappointing, being rather on the "chunky" side, and as most people have the equivalent game, it's probably appearing too late to do well. As usual, you have to guide frogs up the screen avoiding traffic, snakes, crocodiles and diving turtles. If you like the game and don't have a version yet, then this does have the option of fast and slow games, and joystick or keyboard entry, and you can always say that yours is the version all the others are based on.

Microdeal have also released another Tom Mix game — this time it's his version of Golf. You are allowed to choose clubs, direction and when putting, distance. There are various obstructions in the course such as ponds and bunkers, and the green shots are shown to a larger scale. I still prefer Salamander's version to this one, and the graphics are rather disappointing compared to most games that originate from Tom Mix.

A game from Microdeal that I prefer to the Salamander version is Grand Prix. In Microdeal's program, it is the Moroccan race track that is used. Rather than show you the whole circuit, you only see the road just in front of you. As with some arcade versions, you get a bird's-eye view as other drivers wobble about in front of you or slither into you from the side. Control is by means of the joystick, and it needs a very gentle touch to avoid the other traffic. In spite of the well-defined cars and the smooth scrolling, I found it wasn't really in the addictive class, and certainly not as good as the latest racing simulators that are appearing in arcades at the moment.

Cuthbert entertains

A game that was rather more entertaining is Cuthbert Goes Walkabout. Apparently, Cuthbert finds himself on a lunar landing pod, waiting for the Federal Chief to arrive. His job is turning on lights at the corners of a 7 x 5 grid. Invading Moronians wander around after him. Each square he walks round lights up, and the object is to light up all 35 squares. As you are given five Cuthberts, the game isn't too difficult, but each fresh screen contains more Moronians. If you are quick, you can jump over them, but if you're too close to the edge, you disappear off the edge of the screen. This is an original idea skilfully executed, and is my favourite from the selection of new Microdeal programs.

Four-in-one

Dream Software is a new name from Northern Ireland. They supply a tape called simply "Dragon 1" that contains four programs. Golf presents a nice 3-D view of a hole at the start, but from then on, it's text only (plus sounds of the ball whizzing through the air!), which is a disappointment. You can select clubs and putter strengths, but the game isn't too interesting to play. Poker uses low-resolution graphics for the display, but is a simulation of a gambling machine rather than a game of cards. As you play against the machine, and there is hardly any skill involved, there seems to be little point in this type of program, but I suppose it's cheaper than a real machine. Connekt Four (that's how they spell it!) does not actually play the game — it merely uses the screen to display the pieces and checks to see if someone has won. Unfortunately it's not mug-trapped very well, and crashes if you put too many pieces in a column, or if you accidentally enter a letter instead of a number. Fruit Machine has much better graphics, using the high-resolution screen for the display. You have $4 at the start of the game, and there is a hold facility. Again, my comment would be why bother playing a fruit machine with no chance of winning or losing? The cassette is only £4.95, but I would rather pay twice that for one good game than four weak efforts. The only use for it might be during a party when you're bored with pulling crackers.

Last month I was particularly impressed by a program called Ninja Warrior from Programmers' Guild. This month I have been looking at two other games from this new software house. The first is called Pacdroids and is loosely based on Pacman. It is considerably more advanced, however, as you can lay mines in the path of your pursuers. The mazes increase in complexity as you progress, and once again, the game is fast and smooth in action. You can use either joysticks or the keyboard for control, and up to four players can use the game at one time. Although it lacks the originality of Ninja Warrior, it is good value and is more interesting to play than a standard Pac-type game.

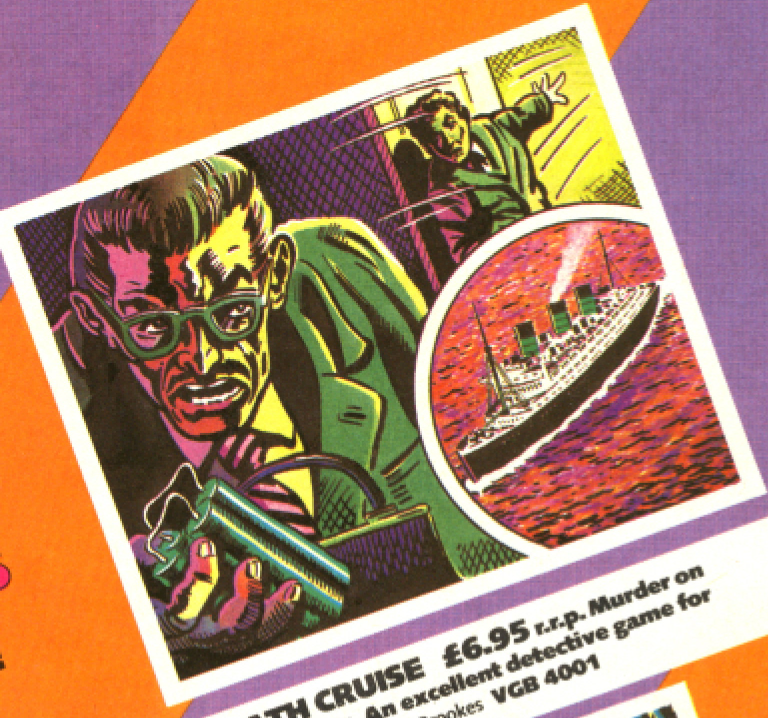
Protector only permits the use of the keyboard for control, and in fact uses six separate keys to move your craft. The first display consists of a menu of options and explains the use of the controls and the scoring system. As the game starts it is seen that this is a version of Defender, complete with aliens kidnapping innocent citizens, smart bombs and mutants. There is a display at the top of the screen to show the approaching hordes from both sides, and you can fly in either direction. This is a reasonable version of Defender, but I still prefer their 'Ninja' to the more derivative games.

Room for originality

Perhaps there is a lesson in this. Arcade manufacturers rarely expect a game to last more than six months unless it's really special. In the micro marketplace, there is always room for originality rather than endless copies of old games. Larger software houses are beginning to realise this, and as well as programmers they often employ "ideas people" to think up original programs. It would make a pleasant change to see even more of them each month. ■

Virgin Games

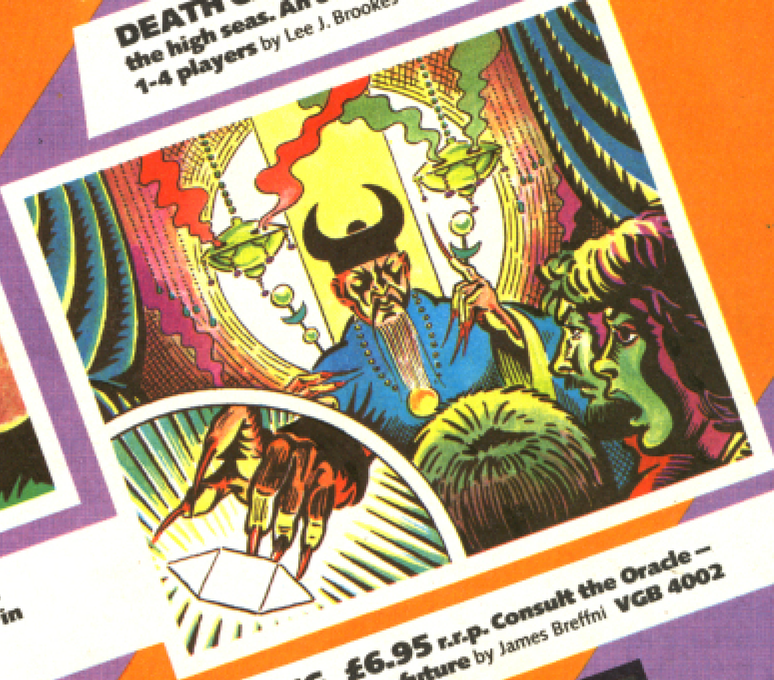
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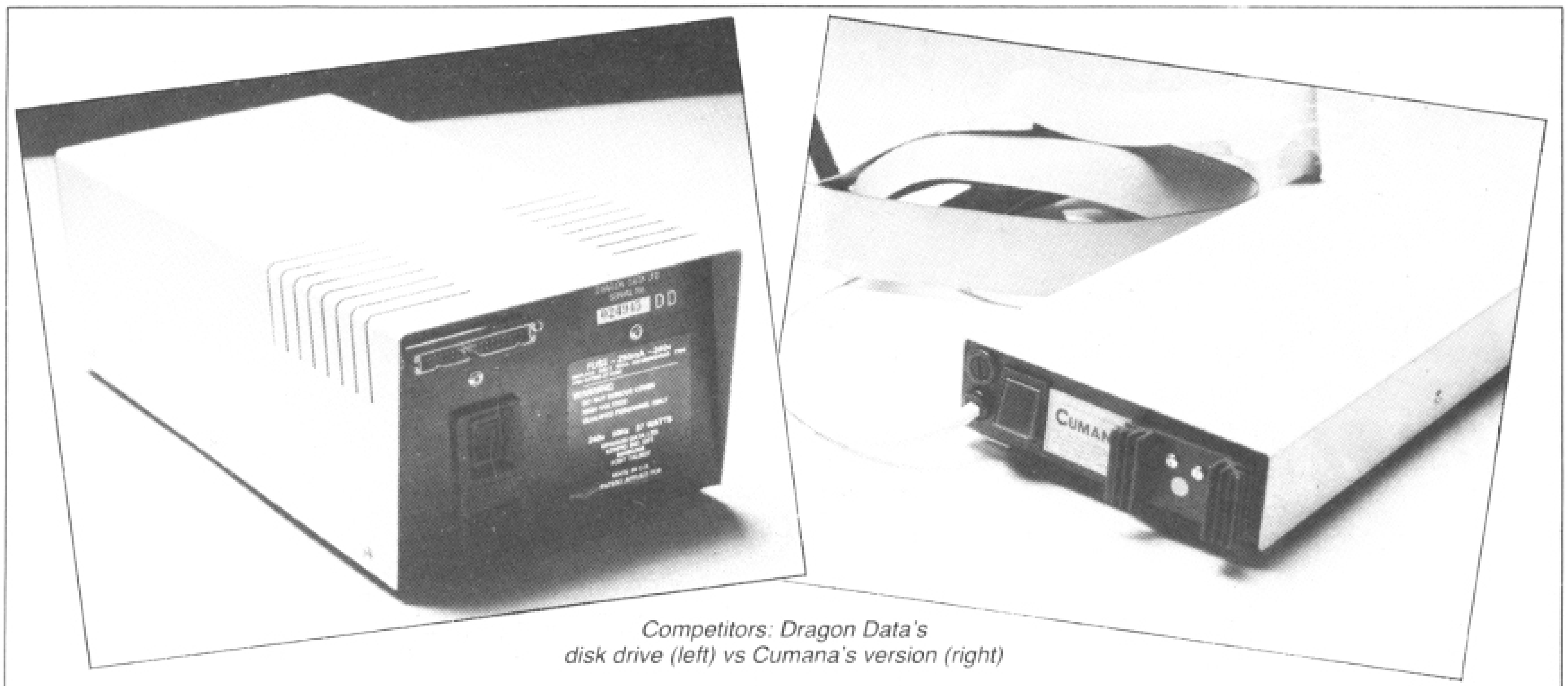
Armed only with a **selection of tools** and **your nerves** you are faced with the challenge of **defusing** an **UneXploded Bomb.**

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Competitors: Dragon Data's disk drive (left) vs Cumana's version (right)

Disk drives: how they measure up

***Keith and Steven Brain** give you the lowdown on disk drives for the Dragon*

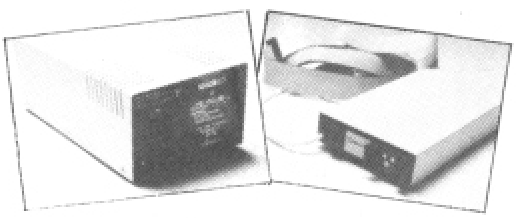
AT LAST DRAGON Data has launched its long-awaited Dragondos disk system to do battle with the upstart single-density Premier Delta system which has been available for some months. However, it is clear that the company is not going to have things all its own way as major disk-drive supplier Cumana has teamed up with Premier to enter the ring with a directly competitive double-density version of Delta coupled to one of its own drives. So let's take a look at what each of the systems offers and how they shape up against each other.

The hardware

The overall construction of the systems is very similar, as both consist of a ROM cartridge containing the Disk Operting System, which is linked by ribbon cable to a double-density single-sided drive offering 170K of storage space. This similarity in approach is hardly surprising in view of the limited memory available on the Dragon 32.

The DOS used by Cumana is a double density version of the Delta system designed by Premier Microsystems which is being produced by Cumana under licence. Although small games cartridges etc fit the port reasonably rigidly these larger boxes (16 × 11 cm) tend to flop about alarmingly and the tenuous nature of the link between the ROM cartridge and the slot is rather worrying. It is a pity that there seems no easy way to make a more solid anchorage point on the Dragon and thus prevent the risk of accidental separation, with its dire consequences to both your data and your hardware.

Connecting the ribbon cable on the Dragon Data system is no problem as the plugs at each end are of different type and polarised so that they cannot be inserted the wrong way round. On the other hand, the Cumana system uses symmetrical connectors, so care must be taken to insert them correctly.



The disk drives of the two systems look very different, in spite of the fact that they are both of slimline design, as whilst Cumana has squeezed its drive into the minimum size of case Dragon Data has opted to provide a much larger box which has room for internal expansion to a second drive.

Both ribbon cables already have the plug for a second drive attached but adding a second Dragon drive also involves making connections to the internal power supply and is listed as a "dealer-fitted" option.

The Dragon Data drive has the usual "Jack-in-the-box" spring-loaded locking door for the disk whereas the Cumana drive uses a simpler arrangement whereby a small lever is turned to lower the read/write head and retain the disk, which is retrieved by simply pulling it out with your fingers.

Documentation

The manual for the Cumana system is essentially based on the excellent document produced by Justin Johnson and Peter Rihan of Premier for their original single-density Delta system. It is comprehensive, meticulous in its approach, and "absolutely first class".

As the Dragon disk system has only just been launched we can perhaps forgive the "temporary" appearance of "An Introduction to Dragondos" by Alan Mayer (after all the cover does indicate that this is a preliminary version) but there seems to be no excuse for the need to include four pages of errata sheets for such a slim volume. Surely you should proof-read manuscripts carefully before you print them, rather than expecting the user to set to work with pencil, scissors and sticky tape. Adequate instructions are an essential part of any product and it is a great pity that Dragon Data (like so many other computer manufacturers) has fallen down on this side of things.

Whereas it has obviously been assumed that the new Delta owner will probably be a novice, with little or no experience of disk operations, the Dragondos manual ▶


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◀ assumes much previous knowledge of disk systems and is far too brief. Dragon Data gives some limited explanations of the all-important file handling techniques, but its effort pales into insignificance beside the very detailed treatment and complex worked examples of different types of applications provided by the Cumana/Premier effort.

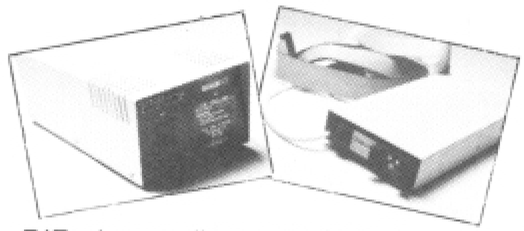
Operating commands

To compare the capabilities of the two operating systems we will look at the commands under a number of different headings. Although different words are used for a number of the fundamental system commands in the two DOS many of these have essentially the same action, and they have therefore been placed opposite each other in the comparison table.

Disc commands

DRIVE/SELECT allow you to log on to further drives. Before you use a disk you must format it to the required specifications. With Dragondos there is a single command (DSKINIT) which can include drive, sides and tracks parameters, but Delta divides this into two commands. CONFIG is extremely versatile, as it also includes sectors/track, step rate and data rate, allowing you to configure the system for any type of drive, and once the configuration is set INIT will format the disk.

With Dragondos the only indications that formatting is in progress are the rhythmic sounds from the drive, but Delta also gives a visual display of progress by printing up each track number as it is formatted. Other useful features of Delta are that it will not format any disk with data already on it without confirmation from the user that this is correct, and that you if you put appropriate parameters into CONFIG you can read single density Delta discs on the double density system.



DIR gives a directory of the names and types of files on the current disk and their size, together with a report of the amount of disk space remaining. Delta differentiates between Basic (.BAS), machine code (.CMD) and data (.DAT) files and specifies the size on "domains" (256 byte slices). Dragondos describes machine code files as binary (.BIN) and disk space in absolute bytes and it also automatically produces back-up (.BAK) files. This means that if you save a file with an existing filename it retains the old copy until you use the same name again, when the last copy becomes the .BAK file, and the first .BAK file is lost. This facility makes it more difficult to completely lose your data if anything goes wrong, but of course does double the amount of disk space used. Dragondos also allows you to access some directory information from within programs with FREE and LOF which give the number of unused bytes on the disk and the length of any particular file, respectively.

In both cases you can COPY files individually or use BACKUP to produce a copy of an entire disk. Where a single drive is in use copying must be done in stages, as the Dragon memory can only hold a small part of the total disk contents at one time, and screen prompts are given to indicate when source and target disks must be interchanged.

The command VERIFY has a different meaning in the two systems. Normally the Delta operating system re-reads the disk whenever it is written to, in order to check that it has been recorded correctly, but this verification can be turned off (disabled) with VERIFY D where speed is more important than ultimate security. In Dragondos VERIFY can also be turned ON and OFF but in this case it is only the directory track, and not the actual disk file, that is verified, although of course you may still have a .BAK file in this case.

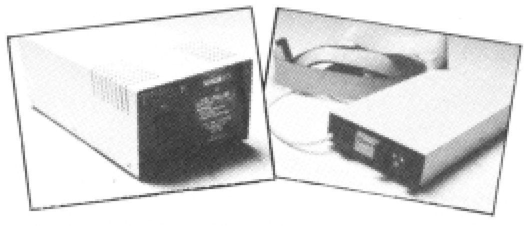
Changing the name of an existing file is done with RENAME/ASSIGN, and files can be deleted with KILL. You can prevent a file being deleted by KILL by protecting (sanctifying) it with PROTECT/ASSIGN;S

Program/memory transfer commands

In both systems you can SAVE named Basic programs and areas of memory (machine code files, graphics pages etc), and then re-LOAD them. If you use RUN rather than LOAD then the file will be both transferred back into memory and executed. Delta has two different words in each case whereas in Dragondos Basic and machine code files are differentiated by the syntax of the command. CHAIN allows you to load and run another program whilst preserving the current variables, and hence transfer information easily between programs.

Finally in this group MERGE/APPEND allows you to join two programs together, although you must ensure that the line numbers are different as the incoming (disk) program has precedence and will overwrite any lines in memory with the same numbers.

DRAGONDOS	DELTA
Disc commands	
DRIVE	SELECT
DSKINIT	CONFIG
———	INIT
DIR	DIR
COPY	COPY
RENAME	ASSIGN
PROTECT	ASSIGN'S
KILL	KILL
BACKUP	BACKUP
VERIFY	VERIFY
FREE	———
LOF	———
Program/memory transfer commands	
SAVE	SAVE
———	SAVEM
LOAD	LOAD
———	LOADM
RUN	RUN
———	RUNM
CHAIN	CHAIN
MERGE	APPEND
Data and file commands	
CREATE	CREATE
———	FILES
———	OPEN
FREAD	INPUT#
FLREAD	LINE INPUT#
FWRITE	PRINT#
CLOSE	CLOSE
EOF	EOF
LOC	———
———	END#
———	RESTORE#
———	FLUSH
———	FIND
SWRITE	———
SREAD	———
———	DIM#
Executive commands	———
BOOT	
———	BOOT
———	BUILD
———	DO



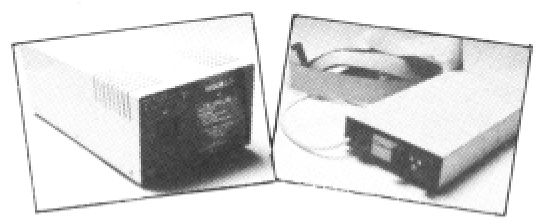
Data and file handling commands

In the area of DATA transfer and FILE handling there is a major divergence between the two systems and to appreciate the significance of this variation you must clearly understand the difference between "serial" and "random access" files.

The essential thing about a serial file is that it is one long string of data and if you want to recover a particular item you must start from the beginning and work you way through the items in sequence until you find what you are looking for. If you have used cassette files on the Dragon then you will be familiar with the general idea of a serial file. If you want to add data to, or delete data from the middle of a serial file then it is usually necessary to rewrite the whole file. Thus, although serial files are a compact way of storing data it is difficult to change or update them.

On the other hand, a random access file is much more flexible as each item (or type of item) is stored in a separate record and can be modified or recovered independently, although as usual nothing is for free and more space is needed by this type of file, and it can take longer to find a particular item unless you know where it was stored.

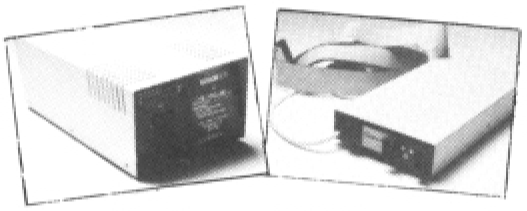
The file handling capabilities of Dragondos are relatively simple, and effectively restricted to the serial type, whereas the Delta system contains much more sophisticated routines which allow the user to easily produce and manipulate all types of record.



Using serial files

In general terms you must carry out a number of operations to set up and use a serial file. The first stage is to CREATE a file with a specified name, thus setting up the format for the file. Whereas in a cassette system you can only deal with one data file at a time, in a disk system you commonly want to transfer data ▶

◀ between a number of FILES at the same time. Programs can communicate with data files through individual input/output channels (up to eight on Delta and 10 on Dragondos), connected with OPEN# n. Data is actually sent to a file with PRINT#/FWRITE, and when the file is finished with you need to CLOSE it to ensure that the last items are transferred. To recover the data you need to OPEN the file and use INPUT#/FREAD to transfer it back. (LINE INPUT#/FLREAD are the equivalent commands for punctuated strings). The EDF command is used to prevent you crashing when you have read to the end of a file.



Dragondos has no OPEN command as files are automatically CREATEd and opened when you use FWRITE, FREAD or FLREAD. Extended versions of these in which FROM and FOR parameters can be specified are also provided, where FROM defines the start point in the file and FOR defines the length of the record, and these allow you to insert and delete data more easily provided you have CREATEd your file and stick to your present format. The LOC function points to the position of the read pointer in the field.

With Delta you need to use all the standard commands described above to set up and manipulate your files but the system is more user-friendly and flexible. In addition END# and RESTORE# are provided to move the read/write pointer to the end and start of the file respectively, and FLUSH clears out a file ready for re-use under the same name.

Personally we prefer the command names used in Delta as they are easier to remember since they correspond closely to their normal Basic equivalents. Whilst you can set up a standard Basic routine to search a serial file for a specified string in either case this can also be carried out more rapidly in Delta with FIND, which sets the read pointer to the start of the target string ready for INPUT#. Another useful feature of the FIND command (especially if your memory is as bad as ours) is that you can use wild characters in the search string (indicated by asterisks), except as the first character. Thus if you remembered that the person whose telephone number you wanted to look up was either CUNNINGHAM or CONNINTHEM you could search for both at the same time with C*NNIN***M.

Random access

The Dragondos manual gives an example entitled "simulated random access" but this really describes a rather inefficient serial file with lots of blank spaces in it. The only other data handling commands in Dragondos are SWRITE and SREAD which write directly to specified disk sectors, and hence could be used to produce a random access database, albeit with a great deal of effort.

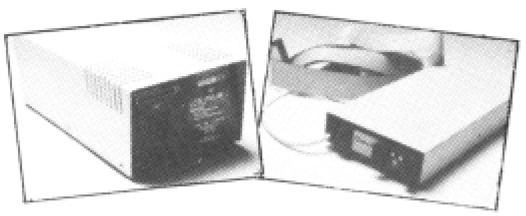
On the other hand, Delta lets you produce and handle random access files as easily as serial files, even allowing you to modify the record length from the industry standard of 128 bytes with the DIM# command. In addition a straightforward method of combining the best of both worlds by producing indexed random access files where FIND is used in a serial index file to point to the random access record is explained.

Executive commands

An important feature of Delta is the suite of executive commands which enable the programmer to easily produce applications software which automatically starts up and operates without any intervention from the user.

BUILD allows you to construct an executive file (which is rather like a program) on disk containing a series of commands and DO enables this series of commands to be accepted as if they were keyboard input and carried out. BOOT causes the disk to automatically carry out a single predetermined instruction when the drive is booted or selected, and as this instruction can be to RUN a program or DO an executive file there is no limit to the chain of action which can be set in motion. Although this facility is not essential to the average hobbyist it is invaluable in any application where it is intended that unskilled personnel should use the Dragon for serious purposes, and it is rather surprising that Dragon Data has neglected this area.

The Dragondos BOOT command is completely different and its function is described as "loading another operating system from disk into memory", which sounds as if the ghost of the 089 operating system still lives.



New Basic commands

The Dragondos cartridge also adds some Basic commands but, although these can be useful, none are particularly dramatic improvements.

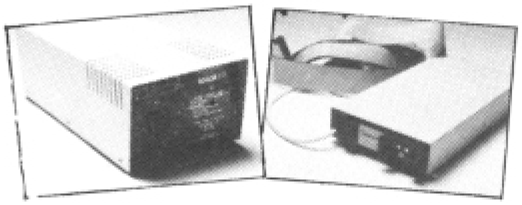
HIMEM gives the highest memory location available to Basic by subtracting the amount reserved for CLEAR. This may be useful if your own memory is bad! FRE# gives the number of free bytes available for strings. More importantly it also forces "garbage collection" (efficient re-stacking of strings). You can therefore use it to control at which points in the program this is carried out, and hence avoid unscheduled pauses when your Dragon independently decides it is time to put its house in order.

ERROR GOTO over-rides the normal error message routine and directs control to a particular line which can use ERR (the error code) and ERL (the line number where the error occurred) to produce a custom error message without halting the program. These functions are useful in complex programs as they allow you to centralise your error checking, but it is not difficult to produce your own versions.

BEEP and WAIT are commands which give a warning sound and temporary program delay which take up less memory than the alternatives.

SWAP exchanges the values of two variables without using dummy variables (eg SWAP X, Y replaces A = X; B = Y; X = B, Y = A.)

Finally, AUTO generates line numbers automatically, from a defined line number and with defined spacing.



Delta options

The Delta controller will still be available separately from premier (unlike the Dragondos cartridge which is only sold as part of a package) so you can still use it with any disks available.

In addition the Premier Encoder 09 editor/assembler/monitor or Toolkit (which adds a very extensive range of useful new Basic commands including all those in Dragondos) can also be fitted within the cartridge to provide the user with a very extensive range of facilities.

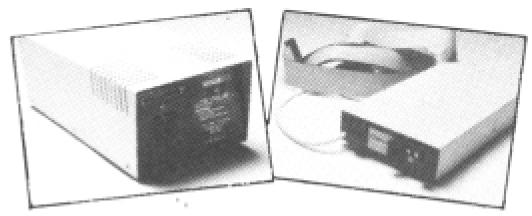
Conclusions

Like the man says: "you pays yer money, you takes yer choice". In our opinion there is no doubt that Delta is a better operating system than Dragondos and it is a pity for the user that Dragon Data decided that it had to produce a competitive product rather than simply adopt the Delta system.

If you just want a faster way of storing and retrieving programs then you will perhaps be satisfied with Dragondos but for any more advanced purposes we firmly recommend Delta.

The decision whether you should buy the "official" product is a difficult one, as disks are not interchangeable so any software Dragon Data itself produces will only run on its own system. However, previous Dragon Data software offerings have hardly been outstanding whereas Premier/Cumana are already offering a number of substantial programs on disk and if they can convince enough software suppliers that their system is superior there is going to be a real fight.

The Price of the Cumana Package was still not finalised when we went to press but it seems likely that the "recommended price" will be about 15 percent higher than that of Dragondos (£275), although it remains to be seen how far individual dealers are prepared to cut their margins to compete. ■



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A US showcase for the Dragon

***Craig Hanna** previews Colour Expo '83, to be held in Pasadena, California, this month*

THE WORLD OF the Dragon seems to keep growing and growing. Here on the US front, I see some different things than Dragon users in the UK do. For instance, this November the first Colour Expo is being held.

Now, you may be asking yourself, "What is this Expo thing?" Well, it's being sponsored by Colour Computer Expositions, a subsidiary of the American magazine, and is being hosted by Colour America Users Group (formerly the Los Angeles Colour Computer Users Group). It is the first time a non-profit organisation has ever hosted an event of this kind.

Expo '83 will be held in Pasadena, California, and is expected to draw 15-20,000 people from all over the world. And yes, you guessed, Dragon/Tano will be there in full force!

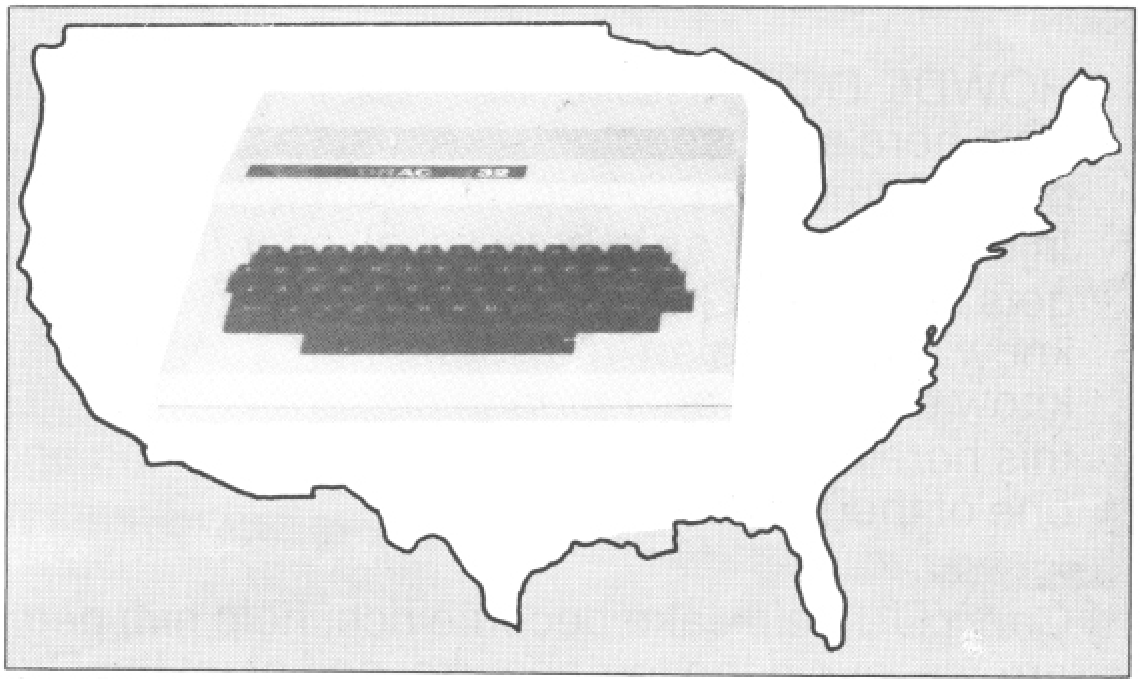
This convention has certainly received some high-powered backing. The mayors of both Los Angeles and Pasadena have proclaimed the weekend of the show as "Colour Computer Weekend" in both cities. The mayor of Los Angeles, Tom Bradley, urged people to attend Colour Expo '83 saying: "This exposition will provide . . . lectures and classes about computers, and a class on programming, all open to the public, emphasising 'Education Through Technology'."

Dragon/Tano will be at the Expo with a brand new national convention booth. "We wanted something that really showed off the Dragon 64," George Merchant, director of microcomputer products at Tano Corporation in New Orleans, said.

"It'll be done in time for the Expo, and it's going to be a really great event. We're really looking forward to it." Tano will be premiering the Dragon 64 on the west coast at the Expo and, according to George, ". . . we have a lot of other exciting things to preview at the show — new stuff everyone will be talking about."

Hall of Fame

The Colour Expo also has a list of guest speakers that looks like a Dragon Programmers Hall of Fame. William Barden, Dennis Kitz, Jake Commander, Steve Bjork, and many others will be speaking. Also in attendance will be the programmers of games such as The King, Blockhead, Junior's Revenge, Pac Attack, and many others. The convention floor will have around 70 booths with retailers and companies displaying their hardware and software goods.



Colour Expo '83 should establish the Dragon's position in the US

"We are really looking to the Expo as being the biggest event of this kind for the Colour Computer and the Dragon in the United States," Kerry Leichtman, editor of *Colour Computer* magazine, said. He thought a moment and added: "Maybe the world!

"There is going to be a lot of things going on at the Expo that'll make it worthwhile for anyone anywhere with an interest in 6809 to come."

Kerry told me that tickets for the event were being sold around the world with people expected from as far away as the UK, France, Germany, Asia and Australia.

I spoke with one of the founding fathers of Colour Expo and President of Colour America Users' Group, Mark Randall. "We've (the group) put a great deal of time and effort into this project, but we think it'll be worth it," he said. "The proclamations, the television interviews, and the events planned by the major computer firms (referring to Dragon/Tano and Radio Shack) were done generally by us. All of us at the group are really excited about it, and I am really looking forward to meeting fellow users from the UK."

The Colour America Users' Group has faced a massive task in preparing for the convention. Colour America has had a hand in practically every planning aspect — from arranging the convention hall to choosing a hotel.

The three-day event will also have a special panel discussion on software piracy — the illegal trading of copyright software, a major problem in the US and around the world.

This controversial subject will be handled by mediator Kerry Leichtman. Both pros and cons to piracy will be presented, and word has it that some of the largest pirates in the United States will be attending incognito to discuss their reasons for piracy. There will be representatives from users groups, programmers, dealers, manufacturers and magazines on the panel.

Surprises planned

There are also a number of surprises planned for the Expo — both Kerry and Mark informed me that they had a lot of things up their sleeves. They hinted at a spectacular video presentation on the Dragon and Colour Computer. They also mentioned a game simulator. This would be like "actually being in the environment the game revolves around", the director of the simulator project, Robin Hudson of Colour America, said.

With around 70 booths at the show, many Colour Expo '83 goers are wondering if three days will be enough. The roster of businesses is impressive. Mark Data, Computerware, Tom Mix, Radio Shack, Dragon/Tano, and many other big names in software and hardware will be in attendance.

"It's an exciting weekend no one with a Dragon or Colour Computer should miss," Kerry Leichtman said. I'll be there — too bad Freddie Laker isn't around any more to fly over more UK visitors. ■

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Take aim —it's open season on ducks!

Fancy yourself as a pretty good shot? Then test your aim with ***R Westwood's*** *Duckshoot.*

DUCKSHOOT TESTS YOUR skill at shooting ducks. Using pmode 3 graphics, you are presented with a flock of green and yellow ducks flying overhead using a short machine code partial scroll. The idea is to try and shoot them all in the allowed time, using the spacebar to shoot.

The Dragon's very good line command is used in line 470 to blank out the duck hit by adding 'BF' and so saves using a blank array.

Program notes

10-240	Initialise and define shapes.
250-290	Main loop.
300-430	Shot fired; test for hit.
440-490	Increment score.
540-640	Number to be drawn.
650-830	Display instructions while machine code is poked.
840-910	Time up and display score.
920-980	Draw score on screen.

The strings used are:

b$	Ducks.
TI$	Draws word 'score'.
t$	Draws tree.
line 240	Draws your man.

```
1 'duckshoot by r westwood
10 CLEAR500,32671
20 HS=0
30 CLS:GOSUB510
40 PMODE3,1:PCLS:DIMB1(12),B2(12)
50 PCLS3
60 B$="BM1,7;R3E2R2F2R4E6R6G3L2G3R2F2R5G2L3G4L4H2L2H2L2H4"
70 DRAW"C2;S3;"+B$
80 PAINT(6,8),2,2
90 GET(0,0)-(30,15),B1,G
100 PCLS3
110 DRAW"C1;S4;"+B$
120 PAINT(7,7),1,1
130 GET(0,0)-(30,15),B2,G
140 TI$="BM2,10;C2;R6U4L6U4R6BD8BR4U8NR6D8R6BR4U8R6D8NL6BR4U8R6D4L6R4F2D2BR4U8NR
6D4NR6D4R6"
150 PCLS3
160 FORX=0TO210STEP45
170 PUT(X,18)-(X+30,33),B1,PSET
180 PUT(X+15,39)-(X+45,54),B2,PSET
190 NEXTX
200 COLOR2:LINE(0,100)-(255,191),PSET,BF
210 T$="C4;U15R1D15R1U15R1D15R1U15L2;C1;H5U4H3G2U3H4E5R3E5R2F4D2F5G3F4D3G2D4L6"
220 DRAW"BM50,191"+T$:PAINT(50,165),1,1:DRAW"BM150,180"+T$:PAINT(150,160),1,1
230 TIMER=0:SC=0:DRAWTI$
240 DRAW"BM221,191;C4;NL2U3R1U3NL4U1H2E2F2G2D1NR4D3R2D3R2":SCREEN1,0
250 D=USR0(0)
260 T=TIMER
270 GOSUB300
280 IFT>3000THENGOTO840
290 GOTO250
300 IFINKEY$=""THENRETURN
310 SOUND1,1
320 X=220
330 FORI=191TO101STEP-5
```

Continued on page 33.

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OASIS SOFTWARE



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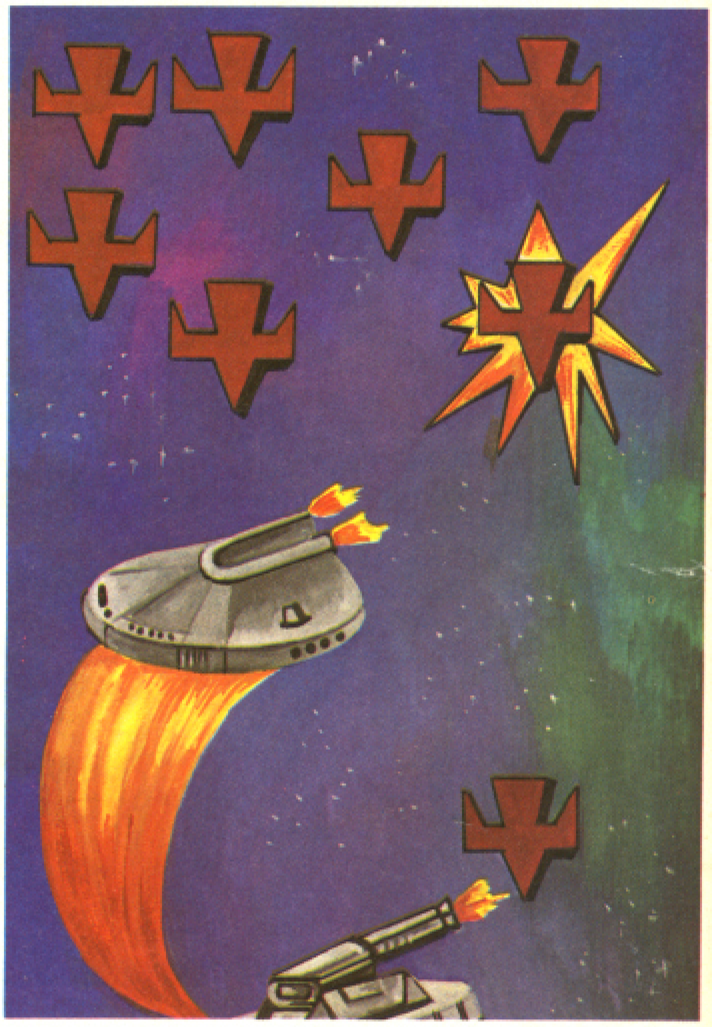
DEALER ENQUIRIES WELCOME

```
340 COLOR1,2:PSET(X,I,1):PSET(X,I-1,1):D=USR0(0)
350 PRESET(X,I):PRESET(X,I-1):X=X-3
360 NEXTI
370 FORI=96TO16STEP-5
380 COLOR1,3:PSET(X,I,1):PSET(X,I-1,1)
390 PRESET(X,I):PRESET(X,I-1):X=X-3
400 BH=PPOINT(126,I+3):IFBH<3THENGOTO440
410 D=USR0(0)
420 NEXTI
430 RETURN
440 PLAY"O1L200AFGCDO4EDO2E"
450 IFBH=2THENSC=SC+50
460 IFBH=1THENSC=SC+20
470 COLOR3:LINE(110,I-11)-(148,I+13),PSET,BF
480 GOSUB920
490 IFSC>340THEN CLS4:GOTO850
500 RETURN
510 CLS4
520 PLAYE$
530 PRINT@202,"DUCKSHOOT";:SCREEN0,1
540 DIMA$(10)
550 A$(0)="BR2U8R6D8NL6BR2"
560 A$(1)="BR5U8L1D1R1D7BR5"
570 A$(2)="BR2U4R6U4L6BD8R6BR2"
580 A$(3)="BR2R6U4NL6U4NL6D8BR2"
590 A$(4)="BR5U8G4R7BD4BR2"
600 A$(5)="BR2R6U4L6U4R6BD8BR2"
610 A$(6)="BR2U8NR6D4R6D4NL6BR2"
620 A$(7)="BR5U5E3NL6BD8BR2"
630 A$(8)="BR2NR6U4NR6U4R6D8BR2"
640 A$(9)="BR8U8L6D4R6D4BR2"
650 FORI=32672TO32754
660 READN:POKEI,N
670 SOUND N+1,1
680 NEXTI
690 DEFUSR0=32672
700 CLS:PRINT@10,"INSTRUCTIONS"
710 PRINT"YOU MUST TRY AND SHOOT ALL THE  BIRDS BEFORE YOUR TIME RUNS OUT TO GET
 YOUR DINNER!!"
720 PRINT"THE LARGE BLUE BIRDS ARE WORTH    20 POINTS"
730 PRINT:PRINT"THE SMALL YELLOW BIRDS ARE WORTH  50 POINTS"
740 PRINT:PRINT"PRESS SPACEBAR TO SHOOT"
750 PRINT:PRINT"PRESS ANY KEY TO START GAME"
760 IF INKEY$=""THEN760 ELSE SOUND3,5 :RETURN
770 RETURN
780 DATA 16,142,0,45,142,8,32,166,16,238,17,239,16,238,19,239
790 DATA 18,238,21,239,20,238,23,239,22,238,25,239,24,238,27,239
800 DATA 26,238,29,239,28,238,31,239,30,238,1,239,132,238,3,239
810 DATA 2,238,5,239,4,238,7,239,6,238,9,239,8,238,11,239
820 DATA 10,238,13,239,12,230,15,231,14,167,15,48,136,32,49,63
830 DATA 38,181,57
840 CLS4:PRINT"**********TIME UP**************"
850 PRINT:PRINT"YOUR SCORE=";SC
860 IF SC>HS THEN HS=SC
870 PRINT"**HIGH SCORE=";HS
880 IFSC>340THENPRINT"WELL DONE!! YOU GOT ALL OF THEM"
890 PRINT@320,"ANOTHER GO (Y/N)";
900 INPUT A$
910 IFA$="Y"THENGOTO150 ELSE END
920 COLOR3:LINE(60,0)-(110,10),PSET,BF:DRAW"BM60,10;C2"
930 TD$=STR$(SC)
940 FORQ=1TOLEN(TD$)
950 J=VAL(MID$(TD$,Q,1))
960 DRAWA$(J)
970 NEXT
980 RETURN
```

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Protector

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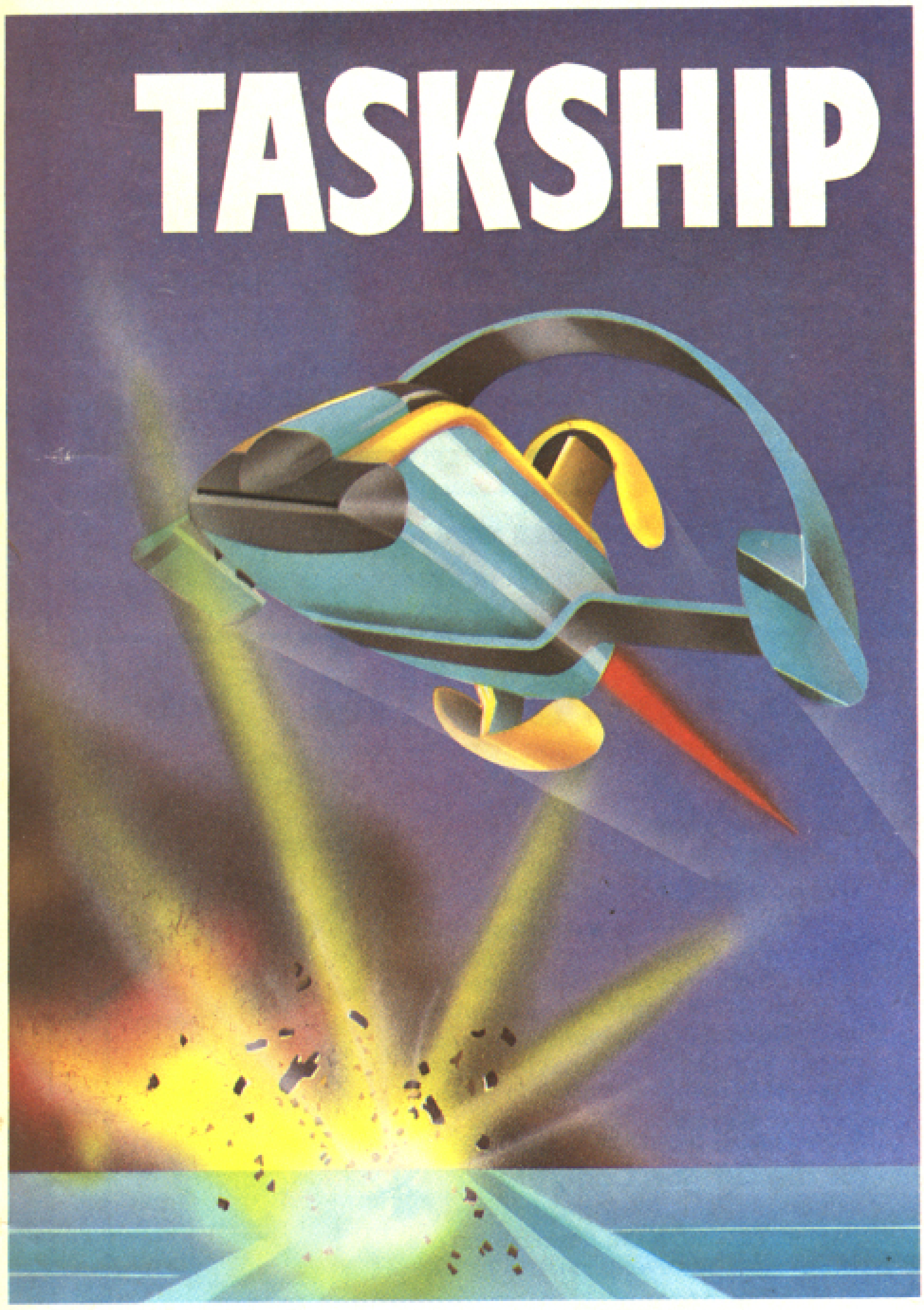
The controller of KS - 5 wiped the beads of sweat from his forehead, the screen was clearing. A quick check of the 'pute only 3 ships operational, reinforcements not to be relied on. How could Galactic control be so negligent. The KS - 5 sector was of paramount importance.It held the only known reserves of Kynite. If this fuel source was lost the whole galaxy could be overun within 6 months. "Heads will roll for this" he cursed silently.

Still no time to worry about the future. He noticed the first blip appear, then another, then another. The beads returned - he'd seen this pattern in sector KH - 4 before it was overun. The GALACTIC RAIDERS had come in waves that swamped bigger defences than he could muster. His only hope of holding the situation until reinforcements arrived was by trying to cut the raiders down before their formation was complete. It meant sending his own ships in individually to almost certain destruction. But it had to be done. He found his hand had already thumped the communicator orb. The words croaked out of a dry throat .

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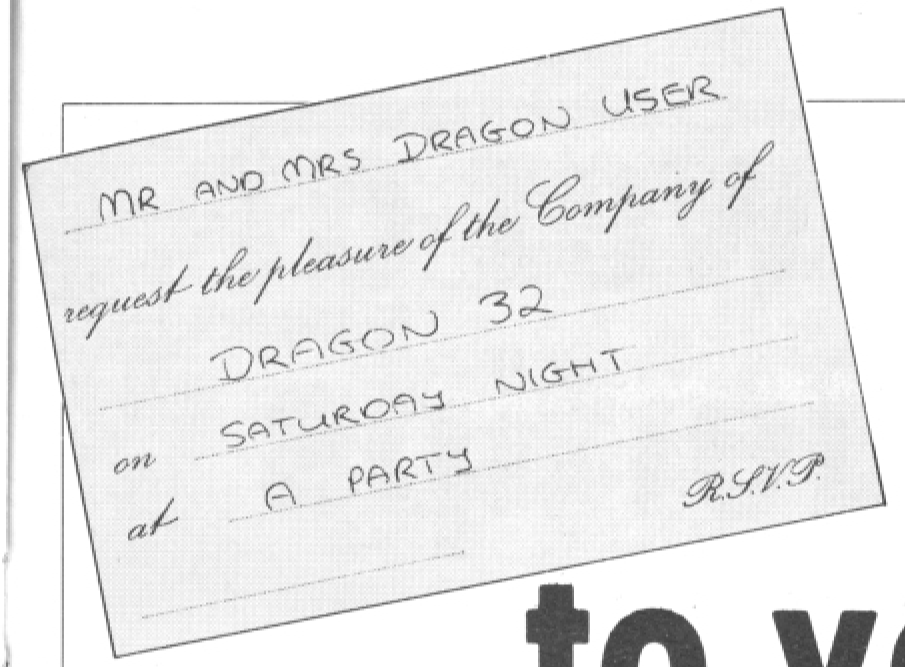
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Access



Invite a Dragon to your party

. . . And to avoid any arguments put him in charge of the music for the night.

"GREAT MACHINE, THE Dragon," I thought to myself as I listened to the Brandenburg Concerto No 3 whilst programming. The music was coming from the little cassette player I use for loading and saving programs whilst still connected to the Dragon, so the sound was being routed through the TV loudspeaker. I was using AUDIO ON: MOTOR ON.

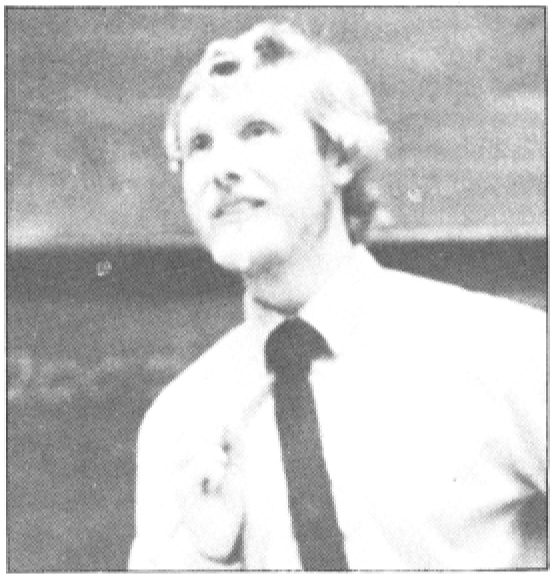
I then tried using a "Fame" cassette, and found it was fun to AUDIO ON and AUDIO OFF in time with the music. I then experimented with turning the sound on and off from within a program: trying to find how much could be cut out before it became unrecognisable. (Some psychologist is bound to try that one out.)

Inspiration

However, being a serious-minded person, I found something missing. What I was missing was *utility*, usefulness, a practical application for my Dragon. But I didn't want to keep my accounts — I said *serious*, not *boring*. Being unwise enough to have children, my inspiration came from them (they often inspire me, but usually it's against the law).

Imagine yourself at a children's party (oh horror!) or at an "adult" (who's kidding?) party where there are those obnoxious games-things. What happens? The music goes on and on, the parcel gets passed, the chairs are circled, the music stops — and cries of "unfair" are heard. Computers cannot be unfair, and so I have written a party program.

***Boris Allan** (below) explains how to do it*



The idea is that the computer controls the tape recorder, switching the sound on and off randomly. To add a touch of excitement there is a loud "ticking" noise, and when it stops it blows a raspberry (my favourite part). The sequence starts with C being pressed, and is restarted after each scrimmage with C again. So, if you want to be heart and soul of the party, here is the way to do it.

Program proper

The program proper starts with line 1040, The computer waits until the key C is pressed (INKEY$ is a "C"); and clears the screen, switches on the sound, starts the cassette motor. A number between 400 and 1000 is then chosen, and the value stored in T1 — the timer is set to zero. A jump (line 1060) is then made to the subroutine at 1080.

Subroutine

The subroutine paints a random-colour blob, at a random place on the screen — except the bottom right-hand corner (or the screen would scroll), which is why the parameter for the RND function is 511, and not 512. At line 1090 the current value of the timer is stored in T, and if the value of T is a multiple of 35 then the computer plays a sound over the music (a "tick"). If the computer plays a sound then the cassette sound is automatically switched off, and so we have to put audio back on. This is the end of the routine.

Value of timer

If, instead of T, one uses TIMER then the ticks are less frequent. The value of the timer changes from one side of the equality, in the IF, to the other; so to be safe store the value of TIMER (and this will go for many other programs).

Back at line 1060, the current value of the timer is checked against T1, and if the timer is less than T1, the line is repeated.

At line 1070 the motor is stopped, a raucous sound is made, and we go back to the start at line 1040.

A short program, an exceptionally useful program, and — I think — a program which could only work on the Dragon. ■

```
1000 ' PARTY MUSIC CONTROLLER
1010 '
1020 ' BORIS ALLAN
1030 '
1040 A$=INKEY$:IF A$="C" THEN 1050 ELSE 1040
1050 CLS: AUDIO ON: MOTOR ON: T1=400+RND(600):TIMER=0
1060 GOSUB 1080:IF TIMER<T1 THEN 1060
1070 MOTOR OFF: SOUND100,8: GOTO 1040
1080 PRINT @ (RND(511)-1), CHR$(143+(RND(7)-1)*16);
1090 T=TIMER: IF INT(T/35)*35=T THEN PLAY"T200;V15;O5;C": AUDIO ON
1100 RETURN
```

String power at your fingertips

***Tim Copsey** helps to unravel some of the knots in string manipulation*

HOW LONG IS a piece of string? Of course this question has no answer, but when talking in terms of computing the maximum length of a string is fixed according to the hardware available. To discover why this is so, you have to consider two questions: What really is a string?; and how does a computer deal with one?

Character	Eight bit register								ACCII code
	128	64	32	16	8	4	2	Units	
A	0	1	1	0	0	0	0	1	97

The Dragon has an eight-bit processor so its binary code takes this form

A string defined

A string is a character or a collection of characters and because a computer works in binary (base 2) each character has a binary code. The Dragon has an eight-bit processor, which means that this code takes the form shown in the diagram.

Thus, if all the stores shown contained a 1 the largest number possible would be represented, 255. The maximum length of a string therefore is 255 characters.

The method used to discover this is very useful as it explains things like why the ASCII codes for characters are from 0 to 255, giving 256 different ones, and the reason that it is convenient to have 512 locations (256×2) on the Dragon's low-resolution graphic screen.

Returning to the subject of strings, the Dragon user is fortunate to have at his or her fingertips a powerful set of string handling commands provided by the resident Microsoft Basic interpreter. Once you can master string handling you realise how invaluable strings are and the potential they offer.

Example program

To demonstrate the usage of str:.ıg and string associated commands I have written a program for you to type in. The program instructs your Dragon to create anagrams for you to solve. The words are in data statements from which, on each game, the computer selects one word at random and then jumbles the letters up. You then have to guess the original word which is on the theme of computers. To maximise your enjoyment when using the program I have arranged the letters in the words in the data statements in such a way as to make them difficult to read whilst keying the program in.

The commands I have used in the program that deal with strings are as follows:

CLEAR 1000 — This reserves memory for string storage and zero's variables. The amount of memory reserved is defined by the number following — in the case of this program, 1,000 bytes.

DIM W$(30) — This dimensions a string array of the size defined in the brackets. In the program the string WS has been divided into 30 different locations ▶

```
10 REM **DRAGON USER***
20 REM **TIM COPSEY****
30 REM **COMPANAGRAMS**
40 CLEAR1000:DIM W$(30),K$(15)
50 FOR W=1 TO 30:READ W$(W):NEXT
60 CLS:PRINT STRING$(32,CHR$(140));STRING$(10,"*");"COMPANAGRAMS";STRING$(10,"*"
);STRING$(32,CHR$(131))
70 PL$="T200L301DFCEDO2GBGBCO3ABCDEFO4DDDEFCAO5AB"
80 NW=RND(29)+1
90 T$=W$(NW):L=LEN(T$):L2=LEN(T$)
100 GOSUB210
110 H=(32-L)/2:PRINT TAB(H)
120 FOR Z=1 TO L:N=RND(L):A$=K$(N)
130 K$(N)=K$(L):IF L>0 THENL=L-1
140 PRINTA$;:NEXT
150 PRINT@256,STRING$(32,"£")
160 TIMER=0
170 PRINT@320,STRING$(20,CHR$(143))
180 PRINT@288,"":INPUT"TYPE ANSWER";D$:IF ASC(D$)>47 AND ASC(D$)<58 AND AT>4 THE
N GOTO240 ELSE IF LEN(D$)<>L2 THEN GOTO 170 ELSE AT=AT+1:IF D$=V$ THEN GOTO 230
ELSE GOTO190
190 PRINT@372,"ATTEMPTS="AT:PLAY"T100L201AAACCCEDDDDD":IF AT>4 THEN PRINT@192,"I
NPUT A NUMBER FOR SOLUTION OR  CONTINUE TO TRY AND SOLVE IT!"
200 GOTO170
210 P=0:FOR X=L2 TO 1 STEP-1:P=P+1:K$(P)=MID$(T$,X,1):V$=V$+K$(P):NEXT:IF J=1 TH
EN PRINT LEFT$(V$,L2):J=0
220 RETURN
230 PRINT:PRINT"YOU SOLVED IT IN"AT"ATTEMPT(S)    IN"TIMER/50"SECONDS.":PLAY PL$:
GOTO 250
```

Continued on page 41.

```
240 PRINT"THE ANSWER WAS ";:J=1:GOSUB210
250 INPUT"ANOTHER COMPANAGRAM";Y$:IF LEFT$(Y$,1)="Y" THEN GOTO40 ELSE CLS:PRINT"
THANK YOU FOR PLAYING":END
260 DATA RETUPMOC,ROSSECORP,ERAWTFOS,YROMEM,ERAWDRAH,GNIDAOL,ECAFRETNI,ROTINOM,S
CIHPARG,DRAOBYEK
270 DATA RETNIRP,KCITSYOJ,RELBMESSA,RELIPMOC,TRAHCWOLF,ETYB,YRANIB,RETERPRETNI,C
LACISIV,GNIVAS
280 DATA TXETELET,YGOLONHCET,SMEDOM,NOITANETACNOC,ELBAIRAV,SEGDIRTRAC,LAREHPIREP
,SROTAREPO,SCINORTCELE,LEXIP
```

◀ each containing a word.

STRING$(10,"*") — This gives a string of the length specified by the number in the first part of the brackets, consisting of the character in the second part of the bracket. In the program it is used for display purposes.

A$ — This is an example of a simple string variable. There are a few of these in the program for storing things such as words and one of the tunes.

CHR$(141) — This gives the character representing the ASCII code in brackets. In the program it is again for display purposes.

LEN(T$) — This gives the length of the string in brackets. It is used in the program to find the length of the guessed word and the length of the anagram.

ASC(D$) — This gives the ASCII code of the string in brackets and is used in the program to see if the input by the user is a number, after 5 guesses.

MID$ LEFT$ RIGHT$ — These three commands are used for slicing strings and I have found them to be the most useful string functions. To slice a string is to split it into its composite parts. The command MID$(T$,X,N) gives N characters of T$ starting at position X in the string. For example, MID$("LOUD",2,2) would give "OU". The commands LEFT$ and RIGHT$("WALKING",4) gives "WALK" because the 4 told the computer to give the first four characters of the string from the left. Similarly RIGHT$("WALKING",3) gives "ING", the last 3 characters starting at the right end of the string. In the program it was only necessary to use only the first two commands MID$ and LEFT$, which have been used to split words into the letters that make them up. I used LEFT$ in conjunction with INPUT to ensure that the computer accepted "Y","YES", "YEP" etc. in response to asking the user if another anagram was required.

These commands make up the bulk of those dealing with strings that are available on the Dragon but some important ones that are not used in the program are:

INKEY$ — A commonly used command that instructs the computer to scan the keyboard to check for a depression.

INSTR(X,A$,B$) — This causes a search of the string A$ looking for occurrences of B$ starting from position X.

STR$(A) — This translates a numeric expression into the string counterpart. A particularly useful application of this command is when using the DRAW command to draw something with co-ordinates that are variables. For example:

10 DRAW"BM"+STR$(X)+","+STR$(Y)+A$.

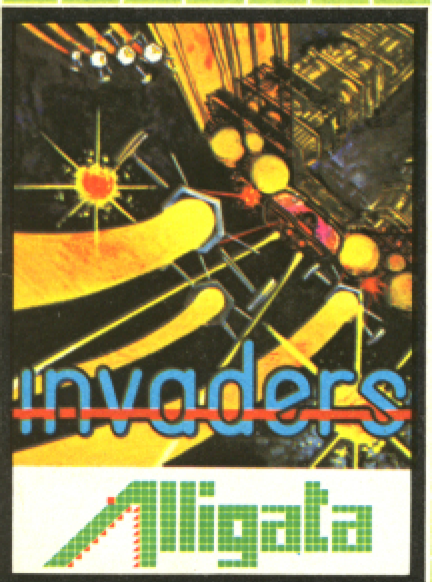
In the example A$ is the thing you want to move according to the variables X and Y.

HEX$(A) — Finds the hexadecimal value of a number. In other words, it changes a number from base 10 to base 16.

By looking at the way that I have manipulated strings in the program and examining the information given you should find strings easier to handle and a very important part of Basic programming. ■

SOFTWARE WITH BITE FOR

DRAGON 32



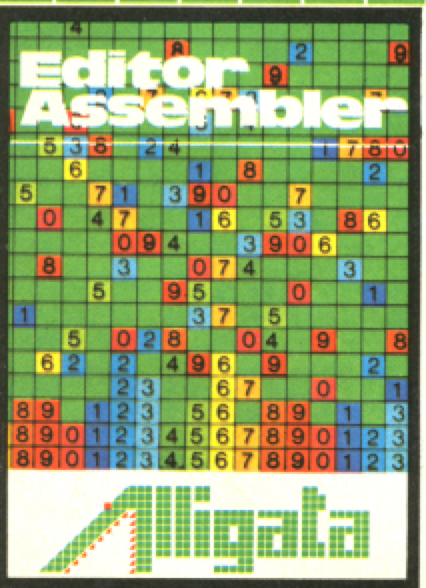
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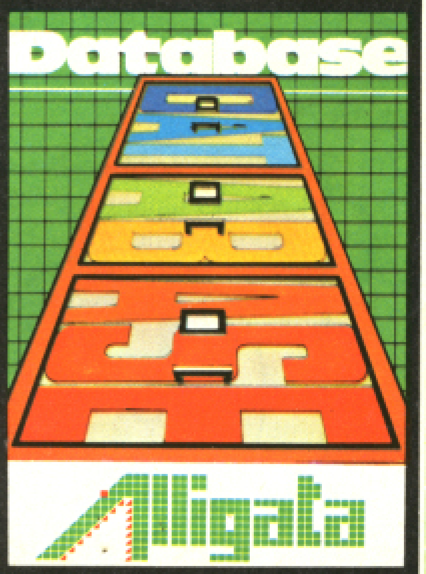
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FIGHT THE EMPIRE!



***Alan Evans'** Battle for Jirdha pits you alone against the combined strength of the Empire. You are the planet Jirdha's only hope. May the Force be with you . . .*

AT THE HEART of this game are two powerful graphic statements, GET and PUT. Used in conjunction with DRAW, CIRCLE, PAINT and the rest of the Dragon's shape-making armoury, GET and PUT enable the user to define his own sprites and to slap them on to a high resolution screen wherever and whenever he wishes.

Because of this versatility it is worth spending a little time examining the use of GET and PUT as illustrated by "The Battle for Jirdha".

GET stores the contents of a small rectangle of high resolution screen in the Dragon's memory. The syntax of the statement requires that you specify the co-ordinates of the top left and bottom right corners of the rectangle. Because the Dragon organises the contents of this small section of screen as an array you need to select an array name and DIM it before using GET.

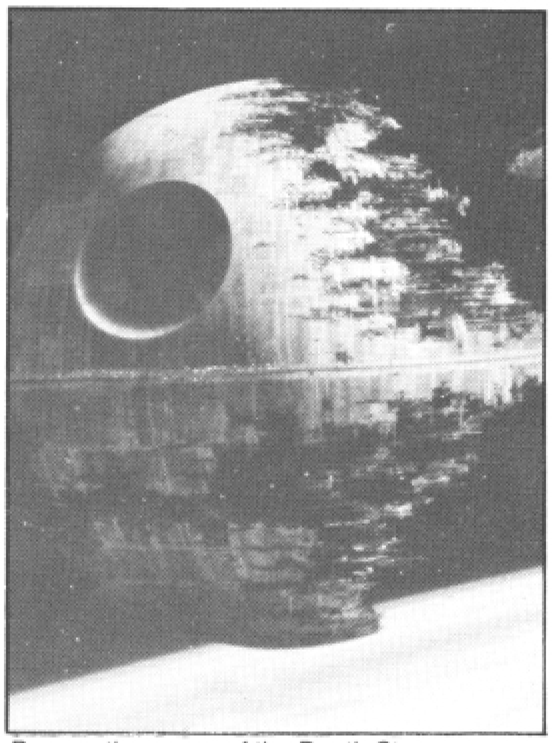
In line 20 a number of arrays are DIMmed. The first of these is called CK and is given a 10 × 10 DIMension. This means that when we GET the array CK, later in the program, we will be GETting the contents of a rectangle that is 10 × 10 screen points in size. This actually takes place in line 140. But notice that prior to GETting this area, line 130 ensured that the 10 × 10 rectangle would contain a buff-coloured circle with a diameter of 10 screen points.

Lines 100-300 contain several examples of shapes being produced and then stored by GETs.

Having designed and stored your sprites, you can now use PUT to produce them on the screen. The PUT syntax is similar to GET in that top left and ▶

```
10 CLS:PRINT@32*8,"       the battle for jirdha":PRINT:PRINT"         BY":PRINT:PRIN
T"       alun evans":FOR DE=1 TO 1000:NEXT DE
20 CLS:TIMER=0
30 PRINT"MOST OF THE SPACE-FLOTSOM THAT  FIND THEMSELVES IN MIRFFEE'S    HAVE A
STORY TO SELL, INCLUDING MIRFEE...WHEN HIS SPEECH CIR-   CUITS ARE FUNCTIONING"
40 PRINT:PRINT"AND HERE IT WAS THAT I HEARD      FIRST OF THE BATTLE OF JIRDHA    W
HERE A LONE KNIGHT DEFENDED A  PLANET AGAINST THE EMPIRE"
50 PRINT:PRINT"HIT ANY KEY"
60 F$=INKEY$:IF F$="" THEN 60 ELSE CLS:PRINT"WITHIN SECONDS NOW, YOU TOO WILLFAC
E THAT EMPIRE. USE THE ARROW KEYS TO CONTROL YOUR HOVER-GUN  USE THE SPACE BAR T
O SHOOT..BUT BEWARE,FOR THE GUN IS OLD AND   YOU WILL HAVE ONLY 2 SHOTS FOR  EAC
H PASS OF "
70 PRINT"THE ENEMY":PRINT"FIVE BOMBS ARE NEEDED TO DESTROYTHE WORLD YOU DEFEND..
FIVE BOMBSOR ONE death star":PRINT"YOU ARE DOOMED. GOOD LUCK AND   GOOD BYE"
80 DIM CK(10,10),CB(10,10),GB(10,14),GN(10,14),BF(11,10),TF(11,10),BM(1,3):GP=0:
YG=150
90 REM preparing screen/sprites
100 PMODE 4,1
110 PCLS
120 REMdraw the death star
```

Continued on page 46.



Beware the power of the Death Star

◄ bottom right co-ordinates of the area must be given, as must the name of the array you are PUTting. In addition, however, you must give the computer information on how to handle the graphic details it has stored away. Using PSET in a line like:

PUT (XD−5, YD−5) − (XD+5, YD+5), CK, PSET

simply reproduces the sprite CK as it was when it was first drawn.

Animation of sprites, of course, involves firstly producing them on the screen, then wiping them out and producing them again in a slightly different location. As including the word PSET in the PUT statement caused the sprite to appear, it was my belief that using PRESET should remove the image. That is, the wipe-out line should read:

PUT (XD−5, YD−5) − (XD+5, YD+5), CK, PRESET.

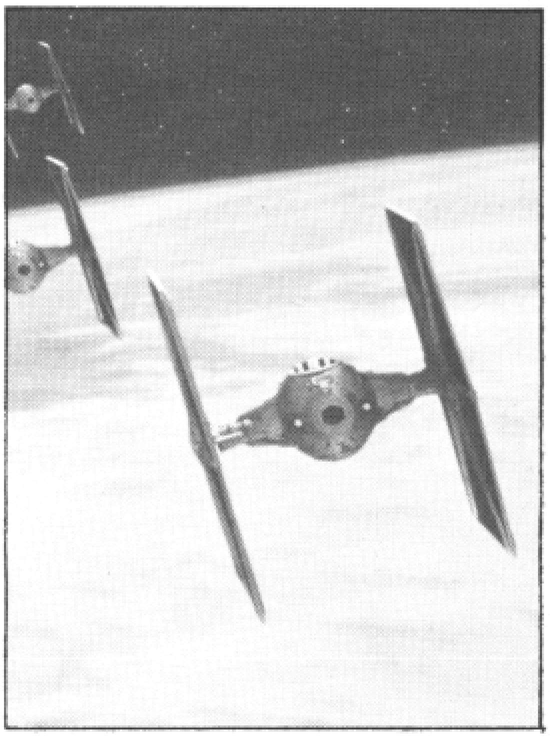
The actual effect of PRESET was unexpected. As required, all the lit pixels that formed the image were turned off. But the previously unlit pixels that had formed the background were now turned on. What appeared on the screen was not a blank section but a negative image of the original sprite.

This is made use of in lines like 610 to show an explosion, but that still leaves the problem of wiping out the sprites unsolved.

This is overcome by GETting areas of blank screen that are the same size as the image to be covered. This is what is being done in line 170: a blank area the same size as the player's gun is being stored, and later PUT on to the gun when that item is being animated. Something similar is going on in line 380 but this time a few random stars are being swept up into the blanking arrays so that flying sprites used in the game do not de-stellarise the galaxy.

Program structure

Lines 10-70 — story and rules displayed.
Lines 80-380 — preparing sprites and battleground.
Lines 420-710 — battle with the Death Star.
Lines 720-890 — end of the world and replay option.
Lines 900-1220 — battle with the T-fighters.



Match wits with the Empire's fighters

Lines 1230-1270 — subroutine to move the gun.
Lines 1280-1370 — sound effects sub routines.

Main variables

Arrays: CK, GN, TF and BM — sprites; CB, GB, BF — blanking out sprites.
GP, YG — co-ordinates of the user's gun.
XD, YD — co-ordinates of the Death Star.
XT, YT — co-ordinates of enemy fighters.
XB, YB — co-ordinates of enemy bomb.
ST — fighter sound pitch.
SC — current score.
HI — best score so far.
T and T2 — variables related to TIMER■

```
130 X=50:Y=50:CIRCLE(X,Y),5,1,1:PAINT(X,Y),5,5
140 GET(X-5,Y-5)-(X+5,Y+5),CK,G
150 PCLS
160 REM draw the gun
170 H=0:V=150:GET(H,V)-(H+9,V+13),GB,G
180 H=3:V=150:LINE(H,V)-(H+3,V+10),PSET,BF
190 H=0:V=160:LINE(H,V)-(H+9,V+2),PSET,B
200 H=0:V=150
210 GET(H,V)-(H+9,V+13),GN,G
220 REM draw t-fighter
230 X=50:Y=X
240 CIRCLE(X,Y),2,5,1
250 DRAW"BM50,50;BM-3,+0"
260 DRAW"U5;D10;U5;BM+6,+0;U5;D10"
270 GET(45,45)-(56,55),TF,G
280 REM draw the bomb
290 LINE(X,Y+3)-(X,Y+5),PSET
300 GET(X,Y+3)-(X,Y+5),BM,G
310 PCLS
320 REM draw the planet
330 CIRCLE(126,190),126,5,.2
340 PAINT(126,190),5,5
350 REM draw stars
360 S1=RND(250):S2=RND(140):SS=SS+1:PSET(S1,S2):IF SS<100 THEN 360 ELSE SS=0
370 PUT(GP,YG)-(GP+9,YG+13),GN,PSET
380 GET(X-5,Y-5)-(X+5,Y+5),CB,G:GET(45,45)-(56,55),BF,G
390 REM screen is now ready
400 SCREEN 1,1
410 REM death star or t-fighter?
420 T=RND(60):T2=TIMER/50:IF T+T2>180 THEN TIMER=0:DS=1
430 IF DS=1 THEN DS=0 ELSE 900
440 REM this is d-star section
450 YD=10:XD=250:DP=RND(150)
```

Continued on page 49.

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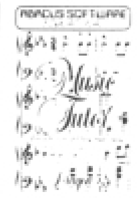
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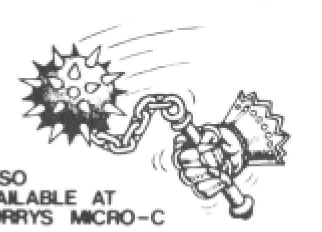
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* The ASSEMBLER can ... Assemble and check for errors, assemble to screen, assemble to printer, assemble to tape, assemble to memory (with or without an offset) assemble with a sorted cross reference, and many combinations of these. The assembler also provides TEXTUAL error messages to help locate programming mistakes quickly. When an error is encountered you can INSTANTLY return to the EDITOR and fix it! Motorola standard assembler syntax is fully supported with the following omissions: OPT, NOG, NOL, STL, PAG, SPC, RPT. Macros are not implemented. The programmer may also use local labels and global labels of up to eight characters in length.
* The MONITOR can ... View memory, examine and change memory, insert a character into a range of memory, shift the contents of memory from one location to another, find a byte or a string of bytes in memory, set/clear a breakpoint. A simple hexadecimal calculator is also provided to assist the programmer in working with HEX numbers.
* MACE's EDITOR/ASSEMBLER/MONITOR, DRAGON's BASIC, a BASIC program, an assembly language source program, and the machine code produced by MACE may ALL reside in memory together! You have instant access to any of them.

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```
460 PUT(XD-5,YD-5)-(XD+5,YD+5),CK,PSET
470 IF XD-5<DP THEN 540 'fall
480 SOUND250,1
490 GOSUB 1240 'move the gun?
500 F$=INKEY$:IF F$=" " THEN FR=FR+1:IF FR<3 THEN LINE(GP+5,YG)-(GP+5,YD+11),PSE
T:COLORO,0:GOSUB 1290:LINE(GP+5,YG)-(GP+5,YD+11),PSET:COLOR 5,0 'REM 4000 is las
er sound
510 PUT(XD-5,YD-5)-(XD+5,YD+5),CB,PSET
520 XD=XD-9:IF XD<5 THEN XD=5
530 GOTO 460
540 REM death star drops
550 PLAY "V25;O1;T10;L24C"
560 GOSUB 1240
570 REM shoot to kill d-star
580 IF FR>3 THEN 660
590 F$=INKEY$:IF F$<>" " THEN 660 ELSE FR=FR+1
600 REM this is a hit
610 IF GP+4>=(XD-4) AND GP+4<=XD+4 THEN LINE(GP+4,YG+1)-(XD,YD),PSET:GOSUB1290:P
UT(XD-5,YD-5)-(XD+5,YD+5),CK,PRESET:COLOR 0,0:LINE(GP+4,YG+1)-(XD,YD),PSET:COLOR
 1,1:GOSUB1330:SC=SC+1000:ELSE 630
620 PUT(GP,YG)-(GP+9,YG+13),GB,PSET:PUT(XD-5,YD-5)-(XD+5,YD+5),CB,PSET:GOTO410
630 REM shot misses d-star
640 LINE(GP+4,YG+1)-(GP+4,YD+6),PSET:GOSUB1290:COLOR 0,0:LINE(GP+4,YG+1)-(GP+4,Y
D+6),PSET:COLOR1,1:FR=FR+1
650 REM death star falls on
660 PUT(XD-5,YD-5)-(XD+5,YD+5),CB,PSET
670 Q1=RND(2):IF Q1=1 THEN Q=-1 ELSE Q=1
680 XD=XD+(Q*RND(15)):IF XD>250 THEN XD=250 ELSE IF XD<5 THEN XD=5
690 YD=YD+9
700 PUT(XD-5,YD-5)-(XD+5,YD+5),CK,PSET
710 IF YD<YG+35 THEN550
720 REM planet is destroyed
730 YD=YG+30
740 FOR BL=1 TO 35
750 XD=RND(250):IF XD<5 THEN 750
760 PUT(XD-5,YD-5)-(XD+5,YD+5),CB,PSET
770 GOSUB1330
780 NEXT BL
790 FOR X=1 TO 5:GOSUB 1290:GOSUB1330:GOSUB1290:NEXT:GOSUB 1360
800 PMODE3,1:FOR G=1 TO 5:SCREEN1,0:COLOR1,4:PCLS:FOR D=1 TO 50:NEXT:COLOR 1,1:P
CLS:FOR D=1 TO 50:NEXT:NEXT
810 CLS
820 PRINT@32*6,"THUS PERISHED JIRDHA":PRINT
830 PRINT"BUT TAKE COURAGE.                YOUR SCORE WAS ";SC
840 PRINT:PRINT"THE HI-SCORE WAS ";HI
850 IF HI<SC THEN HI=SC
860 SC=0:AT=0
870 PRINT:INPUT"DO YOU WANT ANOTHER GAME ";AN$
880 IF AN$="YES" THEN PRINT"OK,STAND BY":GOTO100
890 IF AN$="NO" THEN PRINT"OK,BYE":END ELSE 870
900 REM this is tie fighter
910 FR=0:ST=100
920 XT=RND(200):YT=RND(100)
930 PUT (XT,YT)-(XT+11,YT+10),TF,PSET
940 SOUND ST,1
950 GOSUB 1240
960 IF FR>2 THEN
970 F$=INKEY$:IF F$<>" " THEN 1040
980 REM shoot at t-fighter
990 FR=FR+1:IF FR>2 THEN 1030
1000 IF GP+4>=XT+3 AND GP+4<=XT+7 THEN LINE(GP+4,YG-1)-(XT+4,YT+5),PSET:GOSUB 12
90:PUT(XT,YT)-(XT+11,YT+10),TF,PRESET:GOSUB 1330:COLOR 0,0:LINE(GP+4,YG-1)-(XT+4
,YT+5),PSET:COLOR1,1:SC=SC+100:PUT(XT,YT)-(XT+11,YT+10),BF,PSET:ST=ST+5:GOTO420
1010 REM misses t-fighter
1020 LINE(GP+4,YG-1)-(GP+4,10),PSET:GOSUB1290:COLORO,0:LINE(GP+4,YG-1)-(GP+4,10)
,PSET:COLOR1,1
1030 REM now move tfighter
1040 PUT(XT,YT)-(XT+11,YT+10),BF,PSET
1050 ST=ST+5:IF ST>175 THEN 1110          :REM go to bomb if ready
1060 IX=RND(8):IY=RND(8)
```

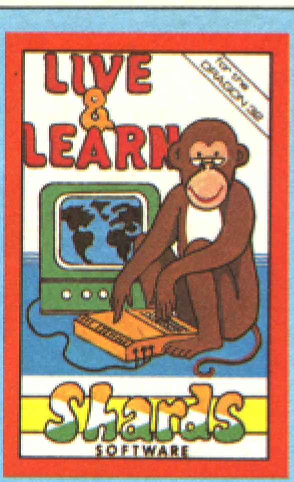
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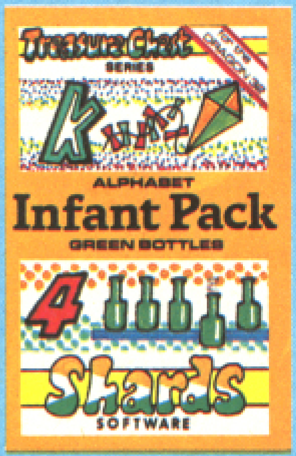
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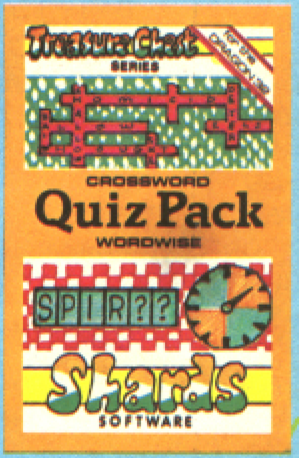
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```
1070 XT=XT+IX:YT=YT+IY
1080 IF XT>244 THEN XT=244
1090 IF YT>YG+25 THEN YT=165
1100 GOTO930
1110 REM this is t-fighter bomb
1120 PUT(XT,YT)-(XT+11,YT+11),TF,PSET
1130 XB=XT+5:YB=YT+11
1140 PUT(XB,YB)-(XB,YB+2),BM,PSET
1150 SOUND RND(255),1
1160 IF XB<GP+3 OR XB>GP+6 THEN 1210
1170 REM bomb to hit gun
1180 PUT (XB,YB)-(XB,YB+2),BM,PRESET
1190 YB=YB+5:IF YB<YG+15 THEN 1140
1200 GOSUB 1290:GOSUB1330:CLS:PRINT @32*5,"ALAS, YOUR GUN IS DESTROYED":GOTO 820
1210 REM bomb to miss gun
1220 PUT(XB,YB)-(XB,YB+2),BM,PRESET
1230 YB=YB+5:IF YB<YG+30 THEN 1140 ELSE GOSUB 1290:AT=AT+1:IF AT>5 THEN YD=YG+30
:GOTO730 ELSE PUT (XT,YT)-(XT+11,YT+10),BF,PSET:GOTO 910
1240 REM this moves gun
1250 IF PEEK(343)=223 THEN PUT(GP,YG)-(GP+9,YG+13),GB,PSET:IF GP>7THEN GP=GP-10:
PUT (GP,YG)-(GP+9,YG+13),GN,PSET:RETURN ELSE 1250
1260 IF PEEK(344)=223 THEN PUT(GP,YG)-(GP+9,YG+13),GB,PSET:IF GP<237 THEN GP=GP+
10:PUT(GP,YG)-(GP+9,YG+13),GN,PSET:RETURN ELSE 1270
1270 PUT(GP,YG)-(GP+9,YG+13),GN,PSET
1280 RETURN
1290 REM this is a laser shot
1300 C=0
1310 PLAY"T20;L8;O1;EFGAB"
1320 C=C+1:IF C<3 THEN 1310 ELSE RETURN
1330 REM this is an explosion
1340 PLAY"O1;T20;L8;CDFE"
1350 RETURN
1360 REM this is super-bang
1370 PLAY"O1;V31;T15;L1;CDCDCDCD"
1380 RETURN
```

Interfacing: the basic technique

***Dr Mark Varney** explains the theory behind designing your own interface*

ONCE IT WAS too expensive to have a computer in the science laboratory other than for the most necessary of experiments. However, the development of the relatively inexpensive personal microcomputer means that scientists now have potentially better and more comprehensive facilities for instrumental control and data collection than ever before.

But there often still remains the problem of interfacing with the outside world. This article will show how a few basic principles of design can be brought together to produce a piece of equipment that is controlled by an ordinary computer, the Dragon 32, and that can better many of the commercially available instruments.

Knowing the need

In electrochemistry, my own field of interest, there are a number of different analytical techniques for measuring the extent or progress of chemical reactions at electrodes. This is not the place to delve deeply into these techniques, but the most important electrochemical parameters measured are potential, current and time. There are a number of commercially available instruments that combine several of the different techniques, but not all of them.

Thus, there is a need for a general purpose, precision unit capable of accepting a wide dynamic range of signals, acting upon them, and accurately controlling various other analogue signals over either long or short periods of time.

This method of applying a signal or series of signals and watching the result is not unique to electrochemistry and so the unit should have numerous applications to other fields (technical or otherwise). The point of emphasis is that all is needed is a form of generating signals, a handful of amplifiers to handle them, and a method of collecting and storing the resulting signals — none of which is at all difficult.

The design is quite straightforward. For practical reasons, to provide the greatest flexibility I chose to provide 16 channels for communication between the Dragon and the outside world — eight for outputting data and eight for inputting data. I shall talk about each of these in turn.

Analogue meets digital

The majority of signals in electrochemistry are of the analogue type — that is, continuous. They may come in various forms (as voltage levels, currents and so on), but they all have to be converted to a form that can be understood by computers.

The traditional method of achieving this is to design an analogue-to-digital (A/D) converter interface around commercially available components. There are many convenient and inexpensive A/D units on the market, such as the ZN427E, but their use in this application can be limited on several accounts.

First, eight such units would be needed for each of the eight input lines, resulting in a high component count and increased size of associated circuit boards; second, the resolution is usually limited to one part in 256 (that is, eight bits). For many other applications this might not ordinarily be of concern, but, if only to be as precise as possible, we have to assume that a higher bit-resolution is abolutely necessary. Conventional A/D components work very satisfactorily at a resolution of up to 12 bits (that is, one part in 4096 — or 0.025% of full scale activity). Although they are available for higher resolution, the use of such components becomes disproportionately more expensive as the number of bits increases.

In addition, the higher the resolution of the A/D unit, the longer is the time taken to produce each value — which brings us back to the first problem. Typical conversion times for cost-effective 12-bit A/D chips are rarely lower than about 50 usec which does not create too much of a problem under most circumstances, polling all eight channels would then take slightly longer than 0.4 msec — not long!

The present data acquisition system is designed around one single chip, the HS9410, which is capable of selecting (multiplexing) one-of-eight analogue inputs and feeding this information into a 12-bit A/D converter and off to an eight-bit microprocessor bus, all within 30 usec. The outputted data has to be read by the Dragon as two eight-bit bytes (one with eight data bits, the other with four data bits and four zeros). So, in the end, what might have resulted in quite a complicated amount of circuitry has come down to a really simple solution. Figure 1 shows the signal highways and basic layout for the A/D interface.

The reason for using the 6821 Peripheral Interface Adaptor (PIA) between the Dragon cartridge slot and the A/D unit is that the PIA can be used to do other things as well as present signals to and collect data from the A/D converter, as will become clearer later. The PIA has two independent input or output ports, designated Port A (PA) and Port B (PB), with eight lines each. One of these ports, PA, is devoted entirely to inputting A/D data, while three PB lines are used as the multiplexing address code in order to select one of the eight channels of analogue data.

'Conditioning'

Before the analogue signals are presented to the A/D converter they normally need to be "conditioned", particularly so if high impedance voltage signals are invovled — drawing too high a current through the input stages of the ADC can significantly alter the original potentials and upset the experiment. This is often the case when working with electrodes and the measurement of very small currents in the μA to nA ranges. ▶

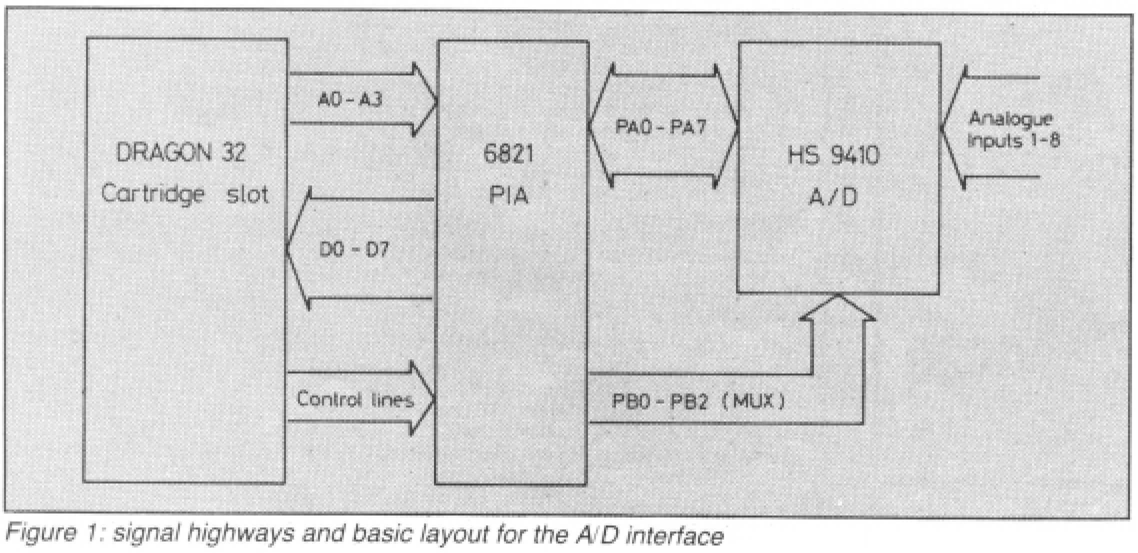


Figure 1: signal highways and basic layout for the A/D interface

◀ Figure 2 shows a method of buffering electrode signals and amplification to useable levels (100mV to 10V). For most applications it has not been found necessary to use "sample and hold" techniques for catching a signal and holding it long enough for the A/D to be able to read it. Only in special circumstances, when it is required to synchronise the measurement with other signals are these circuits included. Anyway, they only add to the expense if there is no good reason to use them.

Digital meets analogue

Getting data from the Dragon to the outside world is perhaps a more cumbersome affair because not only do digital signals have to be sent out on each of the eight channels and converted to an analogue form (D to A conversion), they also have to be held at those values until changed again. Unfortunately, there is no one single chip to do all this.

However, the ability to generate signals by microprocessor control is potentially a big advantage in electrochemistry since it means that the waveform (sinusoidal, ramp, pulse, or whatever) can be stored in memory and then applied to the electrodes at will. The precise form of the signals, their amplitudes, frequency, and so on, are all under software control and will not need external circuitry, range switches, polarity and limit controls etc. — a big saving on equipment costs. Again for the Dragon 32 a 12-bit D/A conversion system was considered the minimum acceptable accuracy for the control of signals to within ±1mV on a 1V full scale sensitivity. Figure 3 shows the essential details.

Two-stage transfer

The transfer of a 12-bit wide word from the Dragon to the digital-to-analogue (DAC) converter takes place in two stages which the Dragon is admirably capable of handling.

If we imagine the "word" to be transferred is 010011101101 in binary, then it is manoeuvered as three four-bit words (or "nibbles"). First of all, the least significant nibble (1101) is transferred to lines PA0 – PA3 (it doesn't matter what the rest of the eight-bit word is on lines PA4 – PA7; they

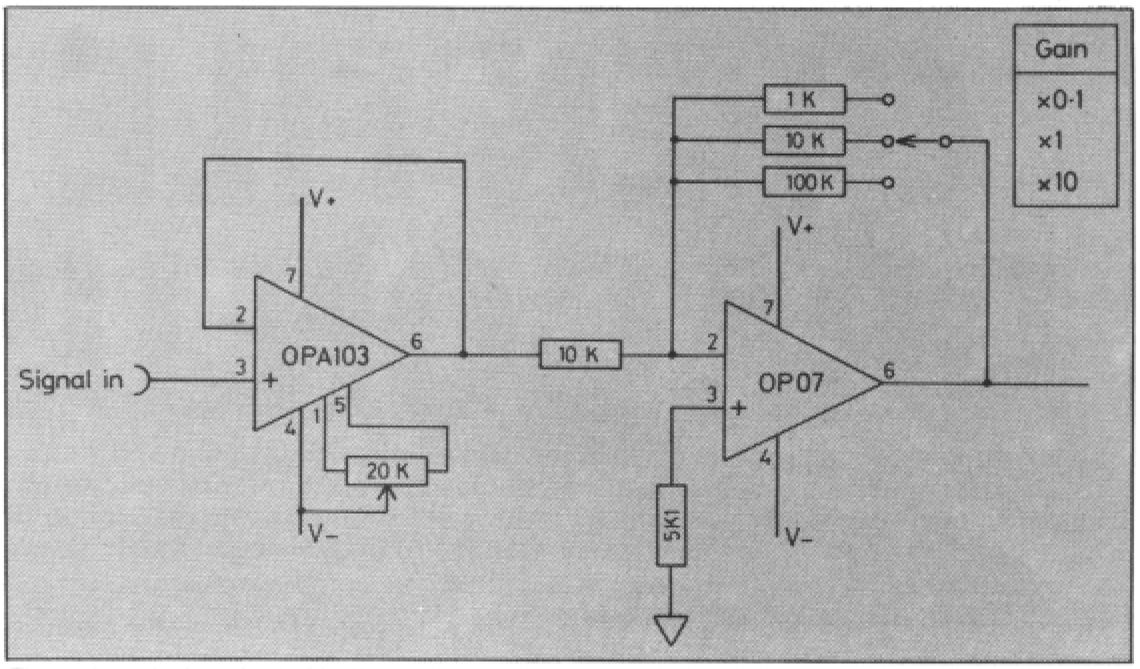


Figure 2: typical method of buffering electrode signals and amplification to useable levels

are usually set to zeros). This feeds information to the upper, intermediate and lower latches (A, B and D). PB0 of PIA 2 is then set high which "clocks" only latch D, transferring only its information on to latch C.

The second step is then for the next two nibbles or the most significant eight bits of the 12-bit word (0100 and 1110) to be put on to the output lines PA0 – PA7, replacing the least significant bits. PB1 of the PIA 2 is now set high; this "clocks" all three latches A, B and C, transferring the whole 12-bit word to the DAC which then outputs an analogue voltage signal to the amplifier A1, configured as a voltage follower so as not to draw current from the DAC output stages.

As can be seen from comparing figures 1 and 3, there are some spare lines from both of the PIAs. These are buffered via 74LS245 chips (octal bus tri-state buffers) and fed to 12V or 24V relays. These are used as simple on/off switches for the operation of ancillary equipment (in electrochemistry there is all sorts of equipment that is ideally suited to this sort of thing — stirrers, timers, chart recorders, etc).

By designing a general purpose interface around these building blocks, it is possible to produce a high quality, versatile instrument at low cost — even if you have only modest experience in electronics. The hardest problem to overcome in most applications like this is not so much the constructional part but the actual practical operation of the interface and the writing of the software. Because the interfaces often need to work at reasonably high speeds (that is, sampling at least every msec or so), machine code programming is almost always needed. With the 6809 processor this is much less of a hardship than with other processors; there are several technical features which make life a lot easier here — such as position independent coding.

Start in Basic

However, in my experience, machine-code programming is usually the last thing to be attempted. In order to ensure everything is in the right order (addressing each of the latches, setting output signals, inputting data on the required channels and so on), all initial programs are written in Basic, and then tried, tested and altered, over and over again until just right, and only then converted into machine code format. This isn't easy — but it does save time!

All of this avoids some of the finer details of interfacing the Dragon, such as using interrupts, data direction registers, control lines, and manipulating the data once in memory. Such things are probably better left until later by the beginner.

The best advice is to define as carefully as possible what one wants, both in specification and performance; then, once this has been determined, the next step is usually very easy — if books can't tell you, then there is always someone who knows how to deal with the problem.

What should be remembered is that any instrumentation envisaged is usually far simpler when implemented digitally rather than by an analogue approach, so it is well worth getting to grips with interfacing techniques. There will be a lot of companies wanting people with this sort of experience in the future!

If anyone is interested in further details about the data acquisition unit they can contact Dr Mark Varney at Electroanalytical Technology, 8 Access Road, West Derby, Liverpool L12 4YN. ■

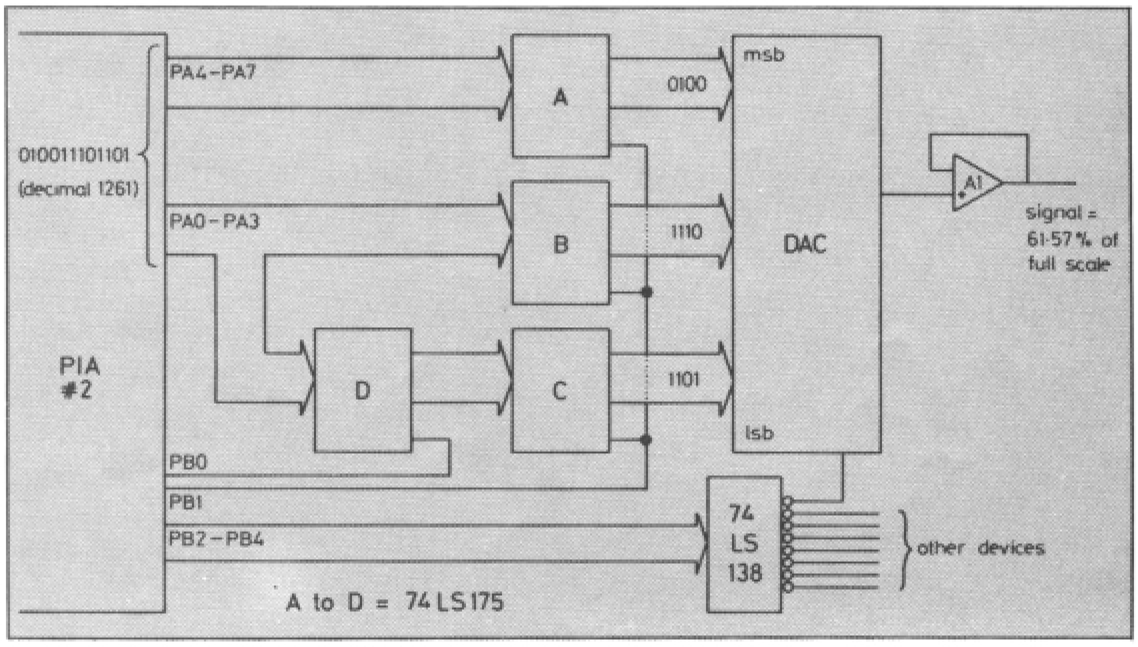


Figure 3: schematic diagram of the operation of the D/A unit

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Chaser

From Trevor King in Craigavon

CHASER IS A game for two players. Each player controls a coloured block, one yellow and one white.

The player on the left of the machine uses the right hand joystick while the player on the right uses five keys, four for direction and one to drop a patch. A 'patch' is light blue and if you walk on one you are transported to centre screen. The left hand player uses his fire button for patches.

The winner is the first player to accumulate 1000 points by eating oranges.

At the bottom of the screen the score and remaining number of patches are shown for each player.

The control keys are: O — up, L — down, M — right, N — left and K — patcher. Both players can be given key control, but in practice it spoils the game as the INKEY$ function only picks up one key at a time, hence joystick control.

```
10 CLS0
20 PRINT@42,"*-CHASER-*";
30 PRINT@226,"-=*PRESS A KEY TO START*=-";:SCREEN0,1
40 A$=INKEY$:IFA$=""THEN40
50 A=1024:BB=0:CC=0:B1=1:C1=-1:B5=5:C5=5:CLS0:KK=0:B=0:C=0
60 FORI=0TO31
70 PRINT@0+I,CHR$(175);
80 PRINT@448+I,CHR$(175);:NEXTI
90 FORI=0TO384STEP32
100 PRINT@32+I,CHR$(175);
110 PRINT@63+I,CHR$(175);:NEXTI
120 POKEA+227,207
130 POKEA+252,159
140 FORI=32 TO160 STEP32
150 POKEA+I+226,175:POKEA+I+61,175:POKEA+I+34,175:POKEA+I+253,175:NEXTI
160 FORI=1 TO 12
170 POKEA+I+386,175:POKEA+I+66,175:POKEA+I+79,175:POKEA+I+80,175:POKEA+I+399,175
:POKEA+I+401,175:NEXTI
180 FORI=1TO11
190 POKEA+I+131,175
200 POKEA+I+143,175
210 POKEA+I+323,175
220 POKEA+I+335,175:NEXTI
230 FORI=0TO64 STEP32
240 POKEA+I+132,175
250 POKEA+I+260,175
260 POKEA+I+155,175
270 POKEA+I+283,175:NEXTI
280 FORI=1TO9
290 POKEA+I+197,175
300 POKEA+I+261,175
310 POKEA+I+272,175
320 POKEA+I+208,175
330 POKEA+206,128
340 POKEA+270,128:NEXTI
350 POKE66+A,223
360 POKE93+A,223
370 POKEA+386,223
380 POKEA+413,223
390 FORJ=1TO1000
400 IF JOYSTK(0)<1 THEN B1=-1
410 IF JOYSTK(0)>62 THEN B1=1
420 GT=JOYSTK(1)
```

Continued on page 55.

```
430 IF GT<1 THEN B1=-32
440 IF GT>62 THEN B1=32
450 IF PEEK(65280)=126 OR PEEK(65280)=254 THEN 530
460 B$=INKEY$
470 IFB$="L"THENC1=32
480 IFB$="O"THENC1=-32
490 IFB$="M"THENC1=1
500 IFB$="N"THENC1=-1
510 IFB$="K" AND J>C9 ANDC5>0  THEN POKEA-C1+252+C,223:C9=J+7:C8=A+252+C-C1:C5=C
5-1
520 GOTO540
530 IF B5>0AND J>B9 THEN POKEA-B1+227+B,223:B9=J+7:B8=A+227+B-B1:B5=B5-1
540 IFB9=J THEN POKE B8,128:B9=0
550 IFC9=J THEN POKE C8,128:C9=0
560 IFPEEK(A+227+B+B1)=175THEN B1=0
570 IFPEEK(B+B1+A+227)=223 THEN POKE B+A+227,128: B=12
580 IF PEEK(C+C1+A+252)=223 THENPOKE C+A+252,128: C=-13
590 IFPEEK(A+252+C+C1)=175THEN C1=0
600 IFPEEK(A+C1+252+C)=255 THEN CC=CC+50:PLAY"V3102T100CCC"
610 IFPEEK(A+B+B1+227)=255 THEN BB=BB+50:PLAY"V3103T100BBB"
620 PRINT@487,BB;:PRINT@504,CC;
630 PRINT@482,"*"B5"*";:PRINT@499,"*"C5"*";
640 IF BB>100 OR CC>100 THEN POKE65495,0
650 IFBB=1000 OR CC=1000 THEN PRINT@228,"GAME OVER. PRESS A KEY.";:SCREEN0,1:GOT
O760
660 B=B+B1:C=C+C1
670 POKEA+227+B-B1,128
680 POKEA+252+C-C1,128
690 POKEA+B+227,159
700 POKEA+C+252,207
710 IF N=4 THEN PO=RND(448)+A ELSE PO=1025
720 IF PEEK (PO)=128 THEN POKE PO,255
730 N=N+1:IFN=5 THEN N=0
740 NEXTJ
750 '
760 AA$=INKEY$:IFAA$="" THEN 760 ELSE POKE65494,0:GOTO50
```

Maths test

From M Saunders in Durham

THIS PROGRAM IS a mental arithmetic test against the clock. If all the sums are correctly completed in the time allowed a graphics display is given.

Program notes

10-50	Displays options and input choice.
70	Executes appropriate subroutine.
80-110	"Play again" option.
120-250	Addition subroutine.
450-580	Multiplication subroutine.
590-740	Division subroutine.
750-800	Results subroutine.
810-940	Graphics display.

```
10 REM"MATHS TEST"
20 CLS:PRINT@10,"MATHS TEST"
30 PRINT@69,"1) ADDITION":PRINT@101,"2) SUBTRACTION":PRINT@133,"3) MULTIPLICATIO
N":PRINT@165,"4) DIVISION"
40 PRINT@265,"ENTER THE NUMBER OF THE SUBJECT YOU WISH TO BE TESTED ON"
50 INPUT X
60 IFX<1 OR X>4 THEN SOUND1,1:PRINT"*ERROR*":GOTO20
70 ON X GOSUB 120,260,450,590
80 INPUT"ANOTHER GO(Y/N)";X$
90 IF X$="Y" THEN 110
100 IF X$<>"N" THEN 80 ELSE END
110 E=0:GOTO10
120 REM**ADDITION**
130 CLS
140 TIMER=0
150 FOR Z=1 TO 20:A=RND(100):B=RND(100)
160 TI=TIMER
170 A$="+":PRINTA;A$;B
180 INPUT Y:C=A+B:IF Y=C THEN 210
190 PRINT"WRONG-";C;"IS THE CORRECT ANSWER"
200 GOTO220
210 E=E+1
220 IF TI>3600 THEN240
230 NEXTZ
240 GOSUB 750
```

Continued on page 57.

```
250 RETURN
260 REM**SUBTRACTION**
270 CLS
280 TIMER=0
290 FOR Z=1 TO 20
300 TI=TIMER
310 A=RND(100):B=RND(100):IF B>A THEN360
320 A$="-":PRINTA;A$;B:C=A-B
330 INPUT Y:IF Y=C THEN400
340 PRINT"WRONG";C;"IS THE CORRECT ANSWER"
350 GOTO410
360 A$="-":PRINTB;A$;A:C=B-A
370 INPUT Y:IF Y=C THEN 400
380 PRINT"WRONG!";C;"IS THE CORRECT ANSWER"
390 GOTO410
400 E=E+1
410 IF TI>3600 THEN 430
420 NEXT Z
430 GOSUB750
440 RETURN
450 REM**MULTIPLICATION"**
460 CLS
470 TIMER=0
480 FOR Z=1 TO 20
490 TI=TIMER
500 A=RND(10):B=RND(15)
510 A$="*":PRINTA;A$;B:C=A*B
520 INPUT Y:IF Y=C THEN 540
530 PRINT"WRONG";C;"IS THE CORRECT ANSWER":GOTO550
540 E=E+1
550 IF TI>3600 THEN 570
560 NEXT Z
570 GOSUB750
580 RETURN
590 REM**DIVISION**
600 CLS
610 TIMER=0
620 FOR Z=1 TO 20
630 TI=TIMER
640 A=RND(100):B=RND(10)
650 C=A/B:D=INT(C):F=C-D:IF F>0THEN640
660 A$="/":PRINTA;A$;B:C=A/B
670 INPUT Y:IF Y=C THEN 700
680 PRINT"WRONG!";C;" IS THE CORRECT ANSWER"
690 GOTO710
700 E=E+1
710 IF TI>3600 THEN730
720 NEXT Z
730 GOSUB750
740 RETURN
750 REM**RESULT**
760 IF Z<19 GOTO 790 ELSE CLS7:PRINT@256,"YOU SCORED";E;"OUT OF 20"
770 IFZ>19 ANDE=20 GOSUB 810
780 GOTO800
790 CLS4:PRINT@10,"TIME UP!!":PLAY"V31L1T4003ABDFGABCEDF":PRINT@256,"YOU SCORED
";E;"OUT OF";Z
800 RETURN
810 REM*GRAPHICS DISPLAY*
820 PMODE3,1:PCLS:SCREEN1,0
830 CIRCLE(40,40),40:CIRCLE(215,40),40:CIRCLE(40,152),40:CIRCLE(215,152),40
840 PAINT(40,40):PAINT(215,40):PAINT(40,152):PAINT(215,152)
850 LINE(92,76)-(96,89),PSET:LINE-(100,85),PSET:LINE-(104,89),PSET:LINE-(108,76)
,PSET
860 LINE(112,76)-(119,76),PSET:LINE-(112,76),PSET:LINE-(112,89),PSET:LINE-(119,8
9),PSET:LINE(112,84)-(115,84),PSET
870 LINE(124,76)-(124,89),PSET:LINE-(133,89),PSET:LINE(138,76)-(138,89),PSET:LIN
E-(147,89),PSET
```

Continued on page 59.

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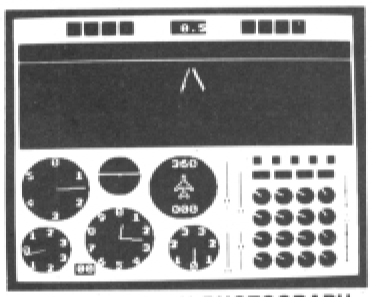
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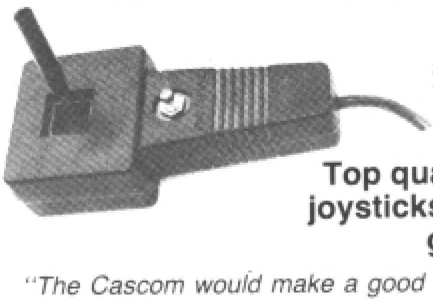
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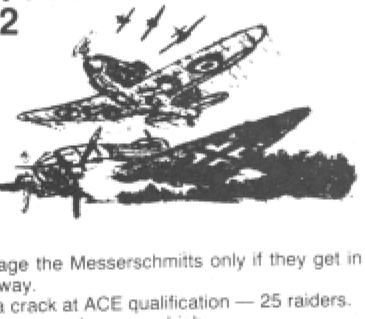
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```
880 LINE(92,92)-(92,106),PSET:LINE-(100,103),PSET:LINE-(100,95),PSET:LINE-(92,92
),PSET
890 LINE(107,92)-(107,106),PSET:LINE-(115,106),PSET:LINE-(115,92),PSET:LINE-(107
,92),PSET
900 LINE(121,106)-(121,92),PSET:LINE-(127,106),PSET:LINE-(127,92),PSET
910 LINE(142,92)-(135,92),PSET:LINE-(135,106),PSET:LINE-(142,106),PSET:LINE(135,
96)-(138,96),PSET
915 FOR I=1 TO 3
920 SCREEN1,1:FOR T=1 TO 5:SOUND60,1:NEXT
930 SCREEN1,0:FOR T=1TO 5:SOUND200,1:NEXT
935 NEXT I
940 RETURN
```

Light cycles

From Murray McGowan in Glasgow

THIS IS A two-player simulation of the light cycles in the movie Tron. The game first asks for a winning score, then it begins. When a cycle crashes the opponent gets the point. For an update on the score press the space bar.

Program notes

50-60	Starts tune.
70-100	Sets up.
110-200	Reads joysticks, cycle 1 check for crash, move.
210-320	Reads joysticks, cycle 2 check for crash, move.
340-430	Displays explosion.
440-450	Checks for winner.
470-560	Says who won.
570-620	Displays score.

```
10 CLS
20 PRINT TAB(8);"TRON LIGHT CYCLES"
30 PRINT :INPUT "WHAT WINNING SCORE";WS
40 POKE 65495,0
50 FOR SO=1 TO 255 STEP 3
60 SOUND SO,1:NEXT
70 X1=128:Y1=30:X2=128:Y2=160:S1=0:S2=0
80 PCLS
90 LINE (0,0)-(256,192),PSET,B
100 SCREEN 1,1:PMODE 3,1
110 J1=JOYSTK(0):J2=JOYSTK(1)
120 IF INKEY$=" "THEN 570
130 IF J1<31 THEN CX=-2:CY=0:GOTO 180
140 IF J1>32 THEN CX=2:CY=0:GOTO 180
150 IF J2<31 THEN CX=0:CY=-2:GOTO 180
160 IF J2>32 THEN CX=0:CY=2:GOTO 180
170 GOTO 210
180 CH=PPOINT(X1+CX,Y1+CY):IF CH=7 OR CH=8 THEN S2=S2+1:EX=X1:EY=Y1:GOTO
 340
190 LINE (X1,Y1)-(X1+CX,Y1+CY),PSET
200 X1=X1+CX:Y1=Y1+CY
210 J3=JOYSTK(2):J4=JOYSTK(3)
220 IF INKEY$=" "THEN 570
230 IF J3<31 THEN CX=-2:CY=0:GOTO 280
240 IF J3>32 THEN CX=2:CY=0:GOTO 280
250 IF J4<31 THEN CX=0:CY=-2:GOTO 280
260 IF J4>32 THEN CX=0:CY=2:GOTO 280
270 GOTO 110
280 CH=PPOINT(X2+CX,Y2+CY):IF CH=7 OR CH=8 THEN S1=S1+1:EX=X2:EY=Y2:GOTO
 340
290 DRAW"C7"
300 LINE (X2,Y2)-(X2+CX,Y2+CY),PSET
310 DRAW"C8"
320 X2=X2+CX:Y2=Y2+CY
330 GOTO 110
340 FOR A=0 TO 15 STEP 3
350 CIRCLE(EX,EY),A,RND(8)
360 SOUND A+1,1:NEXT
370 FOR A=1 TO 15 STEP 3
380 CIRCLE(EX,EY),A,RND(8)
390 CIRCLE(EX,EY),A-1,5
400 SOUND A+1,1:NEXT
410 FOR A=1 TO 15 STEP 3
```

Continued on page 60.

```
420 CIRCLE(EX,EY),A,5
430 SOUND A+1,1:NEXT
440 IF S1=WS THEN 470
450 IF S2=WS THEN 520
460 GOTO 80
470 FOR A=0 TO 20
480 CLS RND(9)-1
490 PRINT @233,"ORANGE WON";
500 NEXT
510 POKE 65494,0:END
520 FOR A=0 TO 20
530 CLS RND(9)-1
540 PRINT @233,"PURPLE WON";
550 NEXT
560 GOTO 510
570 CLS0
580 PRINT @168,"ORANGE";CHR$(128)+CHR$(128);"PURPLE";
590 PRINT @234,S1;:PRINT @242,S2;
600 FOR DLAY=0 TO 500:NEXT
610 SCREEN 1,1:PMODE 3,1
620 FOR DLAY=0 TO 100:NEXT:GOTO 100
```

Music composer

From Kevin Murray in Edinburgh

THIS PROGRAM IS designed to both let the user get to grips with the Dragon 32's PLAY command and to help him design and construct larger and more complex instruction combinations as well as perfect the shorter ones.

The program stores the instructions in an array so that they can be easily manipulated. If you run out of space for your instructions simply change the DIM statements in line 20 and extend the loops and so forth where appropriate. The program has elementary error checking for typing mistakes but this will not deal with syntax-type errors.

Program notes

20	Sets character memory and dimensions the instruction array (maximum of 500 instructions).
30	Sets strings for typing error checking.
60-110	Loads data from tape.
150-210	Checks input for errors.
330	Branches program to chosen function.
390-470	Stores data on tape.
480-520	Prints out data to printer.
590	Resets play command to initial conditions.
600-630	Plays the data.

```
10 REM MUSIC COMPOSER
20 CLEAR 1024:DIMP$(500):CLS:LC=0
30 PC$="ABCDEFG":PN$="#+-":CS$="OLTVP":NU$="1234567890< >+-."
40 INPUT"DO YOU WISH TO WORK ON A STRING STORED ON TAPE (Y-N) ";A$
50 IF A$="N" THEN 120
60 INPUT" WHAT IS THE NAME OF THE STRING ON TAPE (FILE NAME)";SN$:MOTOR ON:AUDIO
 ON:INPUT" POSITION THE TAPE AND PRESS    enter AND THEN PLAY ON THE TAPE RECORD
ER";A$:AUDIO OFF
70 OPEN"I",#-1,SN$
80 FOR L=1 TO 400
90 INPUT#-1,P$(L)
100 IF EOF(-1) THEN 110 :ELSE NEXT L
110 CLOSE #-1:LC=L
120 CLS:PRINT" CODES ARE AS IN THE MANUAL BUT THE CODE X AND THE NUMBER 'NOTE CO
DING' DO NOT WORK. THE EXTRA  KEYS ARE space;clear;enter;↑.   space DELETES THE
LAST NOTE      ENTERED AND PLAYS THE WHOLE      STRING; clear PLAYS THE WHOLE   ";
130 PRINT"STRING AND ALLOWS YOU TO EDIT/  STORE/PRINT THE STRING AND enterEXECUT
ES A NON-NOTE STRING(E.g.Tor V but not # or + or -; notes are automatically play
ed) SO    THAT THE PLAY MODE IS CHANGED   AND ↑ PLAYS THE MUSIC YOU HAVE  JUST C
OMPOSED";
140 IF LC>500 THEN 310:ELSEGOSUB 530
150 IF INSTR(1,PC$,P$)<>0 THEN IF PS$="" THEN PS$=P$: ELSE T$=P$:GOTO220
160 IF INSTR(1,PN$,P$)<>0 THEN IF PS$="" THEN 140:ELSE IF INSTR(1,PC$,PS$)=0 THE
N 140:ELSE PS$=PS$+P$:GOTO220
170 IF INSTR(1,CS$,P$)=0 THEN 140
180 PS$=P$
190 GOSUB 530
200 IF INSTR(1,NU$,P$)=0 THEN 190
```

Continued on page 61.

```
210 PS$=PS$+P$:GOTO 190
220 LC=LC+1:PLAY PS$:P$(LC)=PS$
230 PS$=T$:P$="":T$="":GOTO140
240 REM SPACE BAR PRESSED
250 LC=LC-1:GOSUB 590
260 GOTO 140
270 CLS:REM CLEAR PRESSED
280 GOSUB 590
290 PRINT@416,"";
300 FORL=1 TO LC:PRINTP$(L);" ";:NEXT L
310 INPUT" DO YOU WISH TO EDIT [1]OR STORE[2] OR PRINT OUT [3] THE STRING OR CON
TINUE COMPOSING [4] OR ENDTHE PROGRAM [5]";A
320 IF A<1 OR A>5 THEN 310
330 A=INT(A):ON A GOTO 340,390,480,120,640
340 INPUT" TO EDIT THE STRING ENTER THE   NUMBER OF THE COMMAND TO BE     EDITED
 (E.G. 18) AND THEN CORRECT IT. WHICH COMMAND ";WC
350 PRINT"IS ";P$(WC);" THE RIGHT COMMAND";:INPUT AN$
360 IF AN$="N" THEN 340
370 INPUT" ENTER THE NEW DATA OR XXX TO   DELETE ";ND$:IF ND$="XXX" THEN P$(WC)=
"" :GOTO 310
380 P$(WC)=ND$:GOTO 310
390 REM STORE THE PROGRAM
400 INPUT"UNDER WHAT NAME IS THE STRING   TO BE STORED";SN$
410 IF SN$="" THEN 400
420 MOTOR ON : AUDIO ON
430 INPUT"PLEASE POSITION THE TAPE AND    PRESS ENTER";ZZ$:AUDIO OFF
440 INPUT" PLEASE PRESS RECORD AND PLAY ON THE RECORDER AND THEN PRESS     enter
";ZZ$:OPEN"O",#-1,SN$
450 FOR L=1 TO LC
460 PRINT#-1,P$(L)
470 NEXT L:CLOSE #-1:GOTO310
480 REM PRINT OUT
490 FOR L=1 TO LC
500 PRINT#-2,P$(L);
510 NEXT L:PRINT#-2
520 GOTO 310
530 P$=INKEY$:IF P$="" THEN 530
540 VP=ASC(P$):IF VP=13 THEN P$="":GOTO 220
550 IF VP=32 THEN 240
560 IF VP=12 THEN 270
570 IF VP=94 OR VP=95 THEN GOSUB 590
580 RETURN
590 PLAY"T255O2L4V15P1T2"
600 FOR L=1 TO LC
610 PLAYP$(L)
620 NEXT L
630 RETURN
640 END
650 REM***PRINTED ON THE EPSON RX-80 PRINTER IN DOUBLE STRIKE AND EMPHASIZED MOD
ES***
660 REM**********************************************************
670 REM************** WRITTEN BY K. MURRAY 15/8/83 *************
680 REM**********************************************************
```

Barbcobsnow

From Jason Arnopp

THIS PROGRAM IS called Barbcobsnow because at first the pattern is like barbed wire, then a bit later it looks like a mass of cobwebs and finally changes to look like the aerial view of a snowy patch of ground.

Variables

T = Diameter of circle in screen points.
X = Vertical position of circle.
Y = Horizontal position of circle.

Program notes

10 — Sets mode/clears screen.
20 — Sets random diameter and X,Y co-ordinates of circle.
30 – Draws random positioned circle with random diameter.
40 – Returns to 20 to give new values to T, X and Y to repeat itself.

```
5 REM BARBCOBSNOW 1983
10 PMODE 4,1: SCREEN 1,1: PCLS
20 T=RND(100):X=RND(256): Y=RND(192)
30 CIRCLE (X, Y), T,1
40 GOTO 20
```

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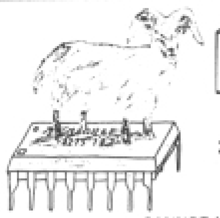
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Robot arm problem

I WISH to plug in a robot arm to the printer port. I have been advised that this can be done, but have come across a problem. Could you tell me whether the port is memory mapped or port mapped? If it is port mapped which one is it mapped on to?

M Eaton, Deal, Kent.

ALTHOUGH THE Dragon's Basic only uses the parallel I/O socket for the printer, it certainly can be used for any control operations such as controlling a robot arm. The actual pin connections are to be found in the additional information booklet.

The port is memory mapped as location $FF02, which is also used as a column select register for the keyboard, so your software will have to take care that a conflict doesn't occur. There are also a couple of other connections other than these 8 data bits. The BUSY line is controlled by bit 0 of location FF22 and the printer strobe connection is addressed as bit 1 of location FF20.

On power up all except the BUSY pin are programmed as outputs (to the printer). You can reprogram the PIA to read these as inputs by use of the data direction register. To use this just clear bit 2 of $FF03 and set or clear the bits for input or output in location FF02. This sounds complicated, but it's not. You will need to use some form of "handshaking" for the robot arm — perhaps the strobe connection — otherwise it is likely to swing all over the place when the keyboard is scanned.

Dragon's bad habit

I HAVE a Dragon 32 (bought last December) with a most annoying habit. Perhaps you can explain it.

At any time, whether putting in a program or running, Os appear at irregular intervals to the left of centre of my screen. This causes programs to go haywire. This happens perhaps once a week for no apparent reason.

Alex Houseman, Blackburn.



THIS IS not the first time I have heard of the mysterious characters which start to appear on the screen or in the program after a few hours in use. The problem could be one of two things.

Your power supply could be at fault, in which case you should try your Dragon at someone else's house with another mains adaptor. More likely the problem is faulty memory chips. There seems to have been a duff batch of Dragons around last Christmas; the other machines I know of with this fault were bought around then.

Your best course of action in this case is to return your machine to the original dealer for replacement or repair.

Power and the Dragon

I HAVE a caravan which has a 12-volt power supply system and now that the winter is coming on I would like to take my Dragon 32 with me when touring. Could you please tell me what is needed to run the Dragon off this power supply and where I could obtain it?

W H Sear, Yeovil, Somerset.

YOU CAN get the power plug for the Dragon quite easily as it is the same connector as used for Atari joysticks. Unfortunately, connecting your Dragon to a car battery is not so simple.

The computer requires two separate power inputs — one at 5 volts and one at 12 volts. You should be able to obtain a transformer which converts 12-volt to 5-volt from your electronics stockist and the 12-volt will be suitable from the battery.

I would stress that you should never connect any power supply to your machine without being absolutely sure of what you are doing — get a knowledgeable friend to help. Also, using your Dragon with any power supply other than that supplied may void your guarantee.

Machine code query

I HAVE recently encountered a problem while writing a machine code program. How would you do the following Basic statements in 6809 machine code?

PMODE 4,1: SCREEN 1,1

Please could you tell me the JSR number required to do this?

D Richardson, Wickford.

ALTHOUGH THERE are 6809 books available, very few of these refer to the Dragon specifically. This is OK until you come up against a problem like this one.

As there have been a number of letters asking how to access various graphic modes from machine code, I have listed below the assembly language necessary to set up the VDG chip for Pmodes 1,3 and 4. To get the second colour set, you should logically OR the contents of $FF22 with 8. The display will start at page one — address 1536.

```
PMODE 1 ld A #165
        st A  $FF22
        st A  $FFC3
        st A  $FFC7
PMODE 3 ld A #229
        st A  $FF22
        st A  $FFC3
        st A  $FFC5
        st A  $FFC7
PMODE 4 ld A #245
        st A  $FF22
        st A  $FFC3
        st A  $FFC5
        st A  $FFC7
```

Colour difficulty

I RECENTLY ran a short program on my Dragon 32 and found some very surprising results.

It was a simple routine to move a red 3 × 3 square across a yellow background diagonally, but before placing a red block on the screen I wanted to test that the space was yellow. I cannot find any error in the logic and wondered if perhaps my machine was faulty.

```
5 CLS 2
10 X1 = 0 : Y1 = 0
20 FOR X = X1 TO X1 + 2 :
   FOR Y = Y1 TO Y1 + 2
30 SET (X,Y,2)
40 NEXT Y,X
50 X1 = X1 + 1 : Y1 = Y1 + 1
60 FOR X = X1 to X1 + 2 : FOR
   Y = Y1 TO Y1 + 2
65 IF POINT (X,Y) <> 2 THEN
   100
70 SET (X,Y,4)
80 NEXT Y,X
90 GOTO 20
100 PRINT "THE COORDS OF
    ERROR ARE ";X;Y," THE
    COLOUR CODE IS"; POINT
    (X,Y)
```

This leads to the error message:

THE COORDS OF ERROR ARE 1 3
THE COLOUR CODE IS −1

The −1 appears because we are back into text mode, but why did it jump out of the loop at all?

John Pancmarento, Burnley, Lancashire.

USING THE low resolution graphics screen gives you a resolution of 64×32 with all nine colours. However, only one colour (other than black) can be in any single character square at any time. If you SET(0,0,2) you will get a yellow dot in the top left-hand corner, but if you type SET(1,1,3) you don't get a yellow and blue dot but two blue dots.

You get the same problem on a Spectrum — although the resolution is high, the colour resolution is much lower. The only thing to do is rewrite your program to use the resolution of 32×16 or use high resolution graphics where there is no such problem.

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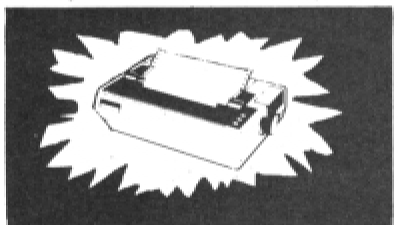
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Competition Corner

Answers to Competition Corner, *Dragon User*, 12/13 Little Newport Street, London WC2R 3LD

A perfect prize

Gordon Lee provides the puzzle, Games and Computers the prize – an MCP-40 printer.

"WE SEE CLEARLY . . . how rare are perfect numbers and how right we are to compare them with perfect men."

— Marin Mersenne (1588-1648)

Last month we took a look at prime numbers, which we labelled — among other things — intriguing, mystifying and unpredictable. If this is the case for primes, then as a class the 'perfect' numbers can only be described as the most exclusive. To date only 28 perfect numbers have been discovered in a search, closely related to certain primes, which began in ancient times and which, at the moment, rests with the discovery of the largest known prime, $2^{86243} - 1$. This scarcity of perfect numbers is in direct contrast to the fact that there are an infinite number of primes.

But first, what is a 'perfect' number?

The smallest perfect number is 6, and if we list its factors we can see why it is called perfect. Six is exactly divisible by 3,2, and 1 and yet these three factors added together will also give the value 6. Similarly, the next highest perfect number is 28, and we can see that if we list all the whole number divisors of 28 and add them together we get a total which is equal to 28:

$$14 + 7 + 4 + 2 + 1 = 28$$

Note that we always include 1, but, of course, not the number itself as a divisor.

The next highest perfect is 496 and you might like to verify this for yourself.

But what has all this to do with prime numbers? To understand that we must go back to the time of Father Marin Mersenne, who in 1644 announced the theory that certain numbers in the form $2^p - 1$ were prime, where p itself was also a prime number. Of course, Mersenne realised that not all prime numbers could be used as p in the formula but he did state that $2^p - 1$ was prime for

p = 2,3,5,7,13,17,19,31,67,127 and 257.

Unfortunately he was wrong in two of his values, as 67 and 257 do not produce primes. He also missed 61, 89 and 107 which do.

Nevertheless, considering the enormity of working out even these values using the methods then available it was still a remarkable achievement, and because of this all primes in this form are now called Mersenne primes.

The largest known prime that we have mentioned is of this type, and is the 28th known Mersenne prime. Now, we have mentioned that there are also 28 known perfect numbers, so does this mean there could be a link somewhere between the two? The answer is that there is, and the link is remarkably simple. It is such that for every Mersenne prime there is a corresponding perfect number, and it is found by the formula:

$$2^{p-1}(2^p - 1)$$

The value within the brackets is any Mersenne prime, and this is multiplied by 2^{p-1}. The table lists the first seven perfect numbers generated when p = 2,3,5,7,13,17 and 19.

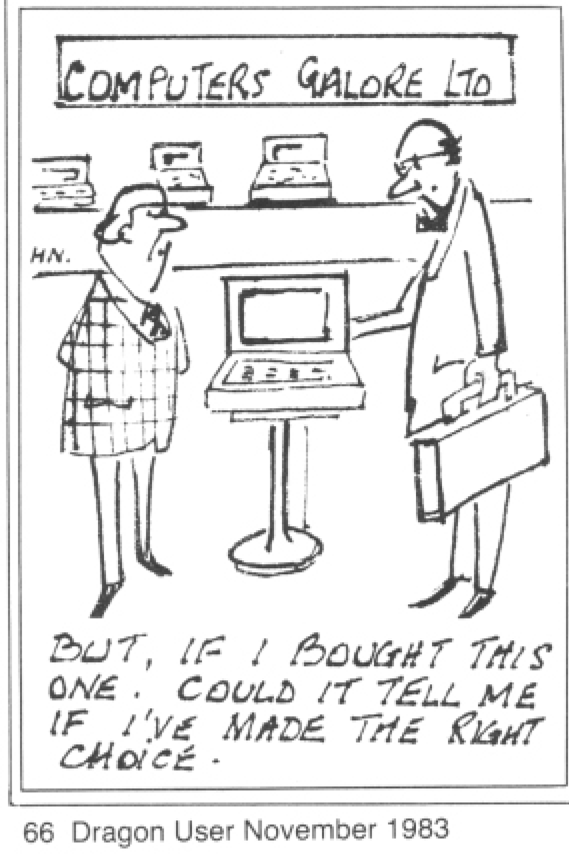
As you can see the numbers are getting rapidly larger, and the perfect number which is derived from the largest known prime so far will be given by:

$$2^{86242}(2^{86243} - 1)$$

In addition to perfect numbers, there are also what are called multi-perfect numbers, whose sum of factors equal two, three or more times that number. For example, the factors of 120 are 1, 2, 3, 4, 5, 6, 8, 10, 12, 15, 20, 24, 30, 40 and 60.

In dealing with multi-perfects the number itself is also included so the sum of the above factors plus 120 will equal 360. As this is three times 120, we say that 120 is tri-perfect. (Note that the perfect numbers we have so far considered would really be bi-perfect if we were to include the number itself as one of the factors).

The number 120 is the smallest tri-perfect. What is the next highest tri-perfect?



p	$2^p - 1$ (Mersenne prime)	2^{p-1}	$2^{p-1}(2^p - 1)$
2	$2^2 - 1 =$ 3	$2^1 =$ 2	6
3	$2^3 - 1 =$ 7	$2^2 =$ 4	28
5	$2^5 - 1 =$ 31	$2^4 =$ 16	496
7	$2^7 - 1 =$ 127	$2^6 =$ 64	8128
13	$2^{13} - 1 =$ 8191	$2^{12} =$ 4096	33550336
17	$2^{17} - 1 =$ 131071	$2^{16} =$ 65536	8589869056
19	$2^{19} - 1 =$ 524287	$2^{18} =$ 262144	137438691328

Prize

THIS MONTH WAREHAM-based Games and Computers is offering an MCP-40 Colour Printer/Plotter as the prize in our competition. The MCP-40 has a number of features that make it a very attractive addition to a computer system — it runs at an average 12 characters per second, prints up to 80 characters per line and can produce charts, lines and graphs in four colours and in fine detail. It is available at a special price from the Dragon 32 Users' Club based at Games and Computers, 31 North St, Wareham, Dorset, BH20 4AD.

Rules

TO WIN THE MCP-40 Colour Printer/Plotter you have to send in the most elegant solution to the puzzle. You must show both the answer to the competition and how to solve it with the use of a Basic program developed on your Dragon 32. As a tie-breaker, complete the following sentence in 15 words or less:

I want to add on MCP-40 Colour Printer/Plotter to my Dragon 32 in order to..................

....

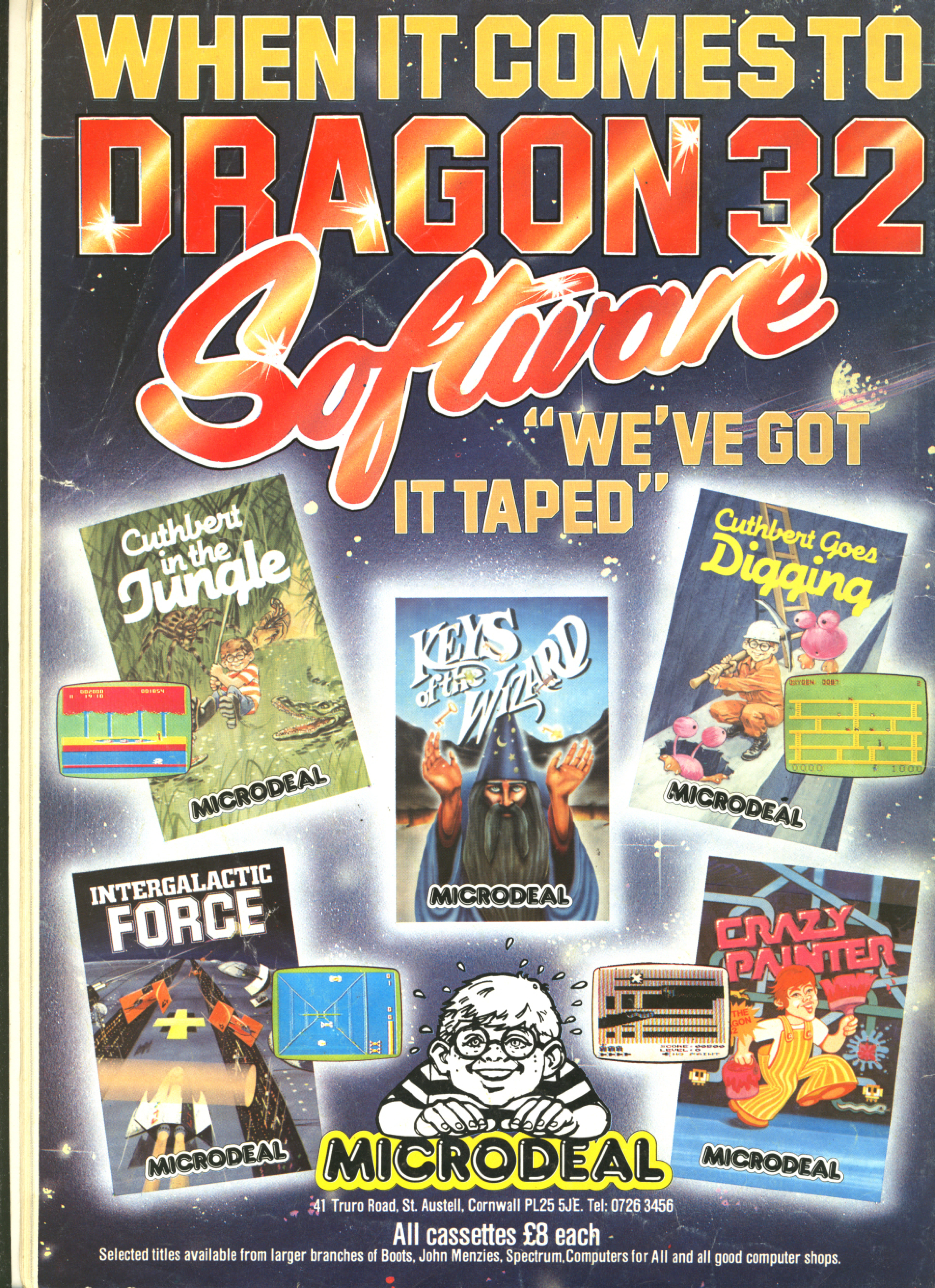
....

....

Your entry must arrive at *Dragon User* by the last working day in November 1983. The name of the winner, and the solution to the puzzle, will be printed in the January issue of *Dragon User*. You may only enter the competition once. Entries will not be acknowledged and we cannot enter into correspondence on the final result. Please send your entries to *Dragon User*, 12/13 Little Newport Street, London WC2R 3LD.

September winner

THE WINNER OF our September competition and recipient of a Namal Supertalker from DRG Business Machines and an RS232 interface from Cotswold Computers, is David Simons of Pinner, Middlesex. He correctly answered that the values of the dice thrown were 4, 4 and 3. This puzzle caused some confusion among readers, many of whom could get three possible answers but could not narrow it down to one. People who struck this problem and would like an explanation of how to solve the problem should write to *Dragon User* and we will send one out to them.



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